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SESSIONAL PAPERS

VOL. XLV.—PART IX.

SECOND SESSION

OF THE

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OF THE

PROVINCE OF ONTARIO

SESSION 1913

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No. 4 Report of the Bureau of Mines for the year 1912. Presented to the Legislature, 28th March, 1913. *Printed.**

No. 5 Report of the Inspector of Division Courts for the year 1912. Presented to the Legislature, 24th February, 1913. *Printed.*

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No. 19 Report of Registrar General upon Births, Marriages and Deaths, for the year 1912. Presented to the Legislature, 4th March, 1913. *Printed.*

No. 20 Report of the Board of Health for the year 1912. Presented to the Legislature, 15th April, 1913. *Printed.*

No. 21 Report upon the Hospitals for the Insane for the year 1912. Presented to the Legislature, 3rd April, 1913. *Printed.*

No. 22 Report upon the Hospitals for Idiots, Orillia, and Epileptics, Woodstock, for the year 1912. Presented to the Legislature, 3rd April, 1913. *Printed.*

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No. 23 Report upon the Feeble-Minded for the year 1912. Presented to the Legislature, 3rd April, 1913. *Printed.*

No. 24 Report upon the Hospitals and Charities for the year 1912. Presented to the Legislature, 9th April, 1913. *Printed.*

No. 25 Report upon the Prisons and Reformatories for the year 1912. Presented to the Legislature, 3rd April, 1913. *Printed.*

No. 26 Report upon the Neglected and Dependent Children for the year 1912. Presented to the Legislature, 25th March, 1913. *Printed.*

No. 27 Report upon the operation of the Liquor License Acts for the year 1912. Presented to the Legislature, 28th February, 1913. *Printed.*

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No. 28 Report of the Department of Agriculture for the year 1912. Presented to the Legislature, 17th April, 1913. *Printed.*

No. 29 Report of the Agricultural College and Experimental Farm for the year 1912. Presented to the Legislature, 17th April, 1913. *Printed.*

No. 30 Report of the Veterinary College for the year 1912. Presented to the Legislature, 17th April, 1913. *Printed.*

No. 31 Report of the Agricultural and Experimental Union for the year 1912. Presented to the Legislature, 17th April, 1913. *Printed.*

No. 32 Report of the Fruit Growers Association for the year 1912. Presented to the Legislature, 17th April, 1913. *Printed.*

No. 33 Return to an Order of the House of the 5th March, 1913, for a Return of copies of all correspondence between the Government, or any member thereof, and Dr. F. B. Fernow, regarding Reforestry work, or any class of work on behalf of the Government of Ontario, in any capacity. Presented to the Legislature, 22nd April, 1913. *Mr. Gamey. Not printed.*

No. 34 Report of the Vegetable Growers' Association for the year 1912. Presented to the Legislature, 17th April, 1913. *Printed.*

No. 35 Report of the Corn Growers' Association for the year 1912. Presented to the Legislature, 17th April, 1913. *Printed.*

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No. 38 Report of the Dairymen's Association for the year 1912. Presented to the Legislature, 17th April, 1913. *Printed.*

No. 39 Report of the Live Stock Association for the year 1912. Presented to the Legislature 20th February, 1913. *Printed.*

No. 40 Report of the Farmer's Institutes for the year 1912. Presented to the Legislature, 20th February, 1913. *Printed.*

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No. 43 Report of the Agricultural Societies for the year 1912. Presented to the Legislature, 20th February, 1912. *Printed.*

No. 44 Report of the Bureau of Industries for the year 1912. Presented to the Legislature, 17th April, 1913. *Printed.*

No. 45 Report of the Inspector of Factories for the year 1912. Presented to the Legislature, 17th April, 1913. *Printed.*

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No. 46 Report of the Temiskaming and Northern Ontario Railway Commission for the year 1912. Presented to the Legislature, 13th March, 1913. *Printed.*

No. 47 Report of the Hydro-Electric Power Commission for the year 1912. Presented to the Legislature, 6th March, 1913. *Printed.*

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No. 49 Return from the Records of the Elections held on the 28th October, 5th November, 1912, and 19th March, 1913. Presented to the Legislature, 4th February and 26th March, 1913. *Printed.*

No. 50 Report of the Archivist for the year 1912. Presented to the Legislature, 21st April, 1913. *Printed.*

No. 51 Report of Librarian upon the State of the Library for the year 1912. Presented to the Legislature, 5th February, 1913. *Not printed.*

No. 52 Return to an Order of the House of the 11th April, 1912, for a Return shewing: 1. The quantity of pine timber cut at or near mileage 81 on the Timiskaming and Northern Ontario Railway during each of the seasons 1907-1908, 1908-1909, 1909-1910, 1910-1911, by the North Land Mining Company, Limited. 2. The price at which the said pine timber was sold to the said Company in each of the said seasons. 3. The names of the persons by whom the pine cut in each of the said seasons by the said Company was measured for the Government. 4. The names of the original incorporators of the said Company and the names of its shareholders and directors in each of the years 1907, 1908, 1910, 1911 and 1912. Presented to the House 13th February, 1913. *Mr. Mageau. Not printed.*

No. 53 Return to an Order of the House of the 9th April, 1912, for a Return of Copies of all correspondence, official or unofficial, reports and written memoranda of every kind passing between the Government or any Minister or officer thereof and any other person or corporation with respect to:—(*a*) The granting of a permit for a tug owned by the Dominion Fish Company to fish on what is known as "the Lizard Island Preserve," during the season 1911, and copy of such permit. (*b*) The granting of a permit or permits to any other body or person or corporation to fish upon the said Lizard Island Preserve during the season 1911, together with copies of such permits. (*c*) The granting of permits to move the tugs of the Dominion Fish Company from one fishing ground to another, in either of the years 1909, 1910, 1911, with copies of such permits. (*d*) The issue of permits permitting the removal of tugs or other fishing boats owned by persons or corporations other than the Dominion Fish Company from one fishing ground to another during the seasons 1909, 1910, 1911, with copies of such permits. (*e*) The issue of a license to a Canadian-owned tug or boat to fish in waters of the Lizard Island Preserve in either of the seasons of 1911 or 1912, with copy of such license, if any. (*f*) The issue of licenses or permits to use 5-lb. or 6-lb. nets on the said Lizard Island Preserve during the seasons of 1911 and 1912, with copies of such licenses or permits. Presented to the Legislature, 13th February, 1913. *Mr. Mageau. Not printed.*

No. 54 Return to an Address to His Honour the Lieutenant-Governor of the sixth day of March, 1911, praying that he will cause to be laid before this House, a Return of copies of all correspondence between the Province of Ontario and the Dominion of Canada, regarding the establishment of Fish Hatcheries in Ontario. Presented to the Legislature, 13th February, 1913. *Mr. Gamey. Not printed.*

No. 55 Copies of Orders in Council and Regulations to be laid before the Legislative Assembly as required by section 27 of the Department of Education Act. Presented to the Legislature, 13th February, 1913. *Not printed.*

No. 56 Copy of an Order in Council approved by His Honour the Lieutenant-Governor the thirtieth day of April, A.D. 1912, pursuant to provisions of Subsection 3 of Section 78 of the Surrogate Courts Act, Chapter 31, 10 Edward VII., that there be paid to His Honour C. F. Sutherland, of the County Court of the County of Grey, from year to year during his tenure of Office, the Surplus Surrogate Fees over and above the amount payable by Statute to the Surrogate Judge of the said County of Grey, provided, however, that the sum paid out of the said Surplus Surrogate Fees shall not in any year exceed the sum of six hundred and sixty-six dollars ($666.00). Presented to the Legislature, 14th February, 1913. *Not printed.*

No. 57 Return to an Order of the House of the 11th April, 1912, for a Return of copies of (1) All correspondence passing between the Government or any Minister or official thereof or any commission under the Government or any official thereof and any other person or corporation with respect to the development of the Smoky Falls Water Power on the Sturgeon River for the benefit of the Town of North Bay. Presented to the Legislature, 17th February, 1913. *Mr. Mageau. Not printed.*

No. 58 Return to an Order of the House of the 17th day of February, 1913, for a Return shewing whether the Prime Minister or any person on his behalf received a telegram purporting to be from one Rowlandson of Elk Lake between the 1st and 11th days of December, 1911, addressed to the Prime Minister with reference to the building of the Elk Lake Branch of the Timiskaming and Northern Ontario Railway. 2. If such telegram was received, the contents of such telegram. 3. If such telegram was received, did the Prime Minister or any person in his name or with his authority or knowledge or on his behalf send a telegram in reply to the said Rowlandson. 4. If so, the date of such telegram and the contents thereof. Presented to the Legislature, 17th February, 1913. *Mr. Elliott. Not printed.*

No. 59 Return to an Order of the House of 2nd April, 1912, for a Return of copies of all correspondence between any person or persons whatever and the Government of Ontario, or any Minister or Official thereof, with respect to the water power on the Montreal River, known as the "Notch" and all applications for a lease of the said water power and any and all leases issued, assignments of any such leases and all other papers and documents in any way relating to the said "Notch" water power or to the Montreal-Cobalt Power Company, Limited, since the 1st day of January, 1905. Presented to the Legislature, 18th February, 1913. *Mr. Mageau. Not printed.*

No. 60 Return to an Order of the House of the 28th March, 1912, for a Return of Copies of (1) All correspondence between the Department of the Attorney-General or any official thereof and any other person whatsoever with respect to certain charges against M. Houston, one time Police Magistrate for the City of Chatham. (2) All charges against the said M. Houston. (3) All Commissions issued, evidence taken and documents submitted in connection with the said charges and the dismissal of the said M. Houston from his office as Police Magistrate. Presented to the Legislature, 18th February, 1913. *Mr. Richardson. Not printed.*

No. 61 Return to an Order of the House of the 20th March, 1912, for a Return of Copies of: 1. All correspondence, reports, estimates or returns of any kind and from any source respecting the quantity of timber cut upon the Munn limits in the seasons of 1909-10, 1910-11 and 1911-12. 2. The amount received by the Government of Ontario for timber dues, stumpage, rentals, or otherwise howsoever in connection with the said limits in each of the financial years 1909-10-11 with full details. 3. The Annual Return made to the Department of the Provincial Secretary by the Munn Lumber Company, Limited, for the years 1909, 1910 and 1911. Presented to the Legislature, 21st February, 1913. *Mr. Sinclair. Not printed.*

No. 62 Return to an Order of the House of the 11th March, 1912, for a Return showing:—1. (*a*) The number of Forest Rangers and Timber Cullers employed by the Government of Ontario in the seasons of 1903-4 and 1904-5. (*b*) The number of feet of timber measured in each season. (*c*) The amount of money paid in each of the said seasons to (1) Forest Rangers, (2) Timber Cullers. 2. Also showing all the information hereinbefore asked for with respect to the seasons 1909-10 and 1910-11. Presented to the Legislature, 21st February, 1913. *Mr. Mageau, Not printed.*

No. 63 Return to an Order of the House of the 17th February, 1913, for a Return of a Copy of the Report made by Mr. E. Saunders, appointed to investigate into certain charges made by Michael Farr of an attempt made to procure money from him in consideration of a license being renewed for the Union Hotel in the Town of Goderich, together with copies of all correspondence which passed between the Government and any person in reference to the said license or the said investigation, the evidence taken by Mr. Saunders and generally all papers, letters, memoranda or papers of any kind and description relating to the said license, including all papers, and correspondence relative to the refusal of a renewal of such license. Presented to the Legislature, 21st February, 1913. *Mr. Proudfoot. Not printed.*

No. 64 Return to an Order of the House of thirteenth day of April, 1912, for a Return of:—(*a*) All memorials, resolutions, letters or other written memoranda received by the Government or any Minister or official thereof since the 1st day of January, 1910, from any individual, public officer or organization with respect to the increase of the number of Judges of the Supreme Court of Judicature for Ontario or with respect to the changes in the constitution of the Supreme Court of Judicature for Ontario provided for in sections 1 to 19 inclusive, of The Law Reform Act, 1909. (*b*) Copies of all letters or written memoranda from the Government or any Minister or official thereof to any individual, public officer, or organization with respect to the said two subject matters, or either of them, since the said date. Presented to the Legislature, 26th February, 1913. *Mr. Elliott. Not printed.*

No. 65 Statement of the Auditor made pursuant to the provisions of Section 13, subsection 2, of the Audit Act as amended by Section 6, of Chapter 10, 9 Edward VII. Presented to the Legislature, 28th February, 1913. *Printed.*

No. 66 Return to an Order of the House of the 14th March, 1912, for a Return showing:—How many male patients have been admitted to each of the Provincial Institutions for the Insane, Feeble Minded, and Epileptics during the three years beginning Jan. 1st, 1909, and ending Dec. 31st, 1911. How many female patients were admitted to these institutions during the same years. How many male patients were discharged from each of these institutions during the same three years. How many female patients were discharged from each of these institutions during these years. Of these male patients discharged: 1st. How many were discharged recovered; 2nd. How many were discharged improved; 3rd. How many were discharged unimproved. Of the female patients discharged: 1st. How many were discharged recovered; 2nd. How many were discharged improved; 3rd. How many were discharged unimproved. Of the female patients discharged how many were under 45 years of age. Of the patients admitted to each of these institutions during the years 1909, 1910 and 1911 how many were admitted for the first time. How many were admitted for the second time. How many were admitted for the third time. How many had been admitted more than three times. In how many of these cases admitted during these years is there evidence that the patients have become the father or mother of children after the first attack of insanity. In how many of these patients is there a history of insanity, epilepsy or imbecility in the father, mother, brother or sister of the patient. In how many of these patients is there a history of insanity, epilepsy or imbecility in the children of the patients. How many patients are in each of these institutions who have had a father,

mother, son or daughter in an asylum at some time. Presented to the Legislature, 28th February, 1913. *Mr. Godfrey. Not printed.*

No. 67 Return to an Order of the House of the 19th February, 1913, for a Return showing:—1. The number of meetings of the Advisory Council of Education held in each of the years 1909, 1910, 1911 and 1912. 2. The total number of meetings attended by each of the different members of this Council during each of the said years. 3. The total number of votes received by each candidate for representative of the public school teachers and for each candidate for representative of the high school teachers for each of the said years. Presented to the Legislature 28th February, 1913. *Mr. Marshall. Not printed.*

No. 68 Orders in Council issued under the provisions of Section 10 of Cap. 2, 2 George V. Presented to the Legislature, 3rd March, 1913. *Not printed.*

No. 69 Return to an Order of the House of the 3rd March, 1913, for a Return showing:—1. Copies of the Culler's report made by the Fort Frances Lumber Company for the logging seasons of 1909-10, 1910-11, 1911-12. Presented to the Legislature, 4th March, 1913. *Mr. Kohler. Not printed.*

No. 70 The Mining Industry in that part of Ontario served by the Timiskaming and Northern Ontario Railway for the year 1913. Presented to the Legislature, 11th March, 1913. *Printed.*

No. 71 Report of T. G. McMillan, covering investigations at James' Bay during 1912. Presented to the Legislature, 11th March, 1913. *Printed.*

No. 72 Report on the increase of the food supply for Ducks in Northern Ontario by G. R. Mickle, with description of edible plants by R. B. Thompson. Presented to the Legislature, 11th March, 1913. *Printed.*

No. 73 A Return to an Order of the House of the 26th February, 1913, for a Return showing: 1. All lands (other than the Railway's right of way) owned by the Timiskaming and Northern Ontario Railway Commission situate in the various municipalities of the Province, stating the municipality in which the land is situate, the area and estimated value of the land, and showing which are mineral lands, agricultural lands and town lots. 2. All lands (other than the Railway's right of way) owned by the Timiskaming and Northern Ontario Railway Commission situate in any unorganized territory within the Province, stating the unorganized territory in which the land is situate, the area and estimated value of the land, and showing which are mineral lands, agricultural lands and town lots. Presented to the Legislature, 10th March, 1913. *Mr. Atkinson. Not Printed.*

No. 74 Return to an Order of the House of the 3rd March, 1913, for a Return showing:—1. How much the Government has spent on private detective work in each of the years 1910, 1911 and 1912. 2. How much of the amount mentioned in the first paragraph hereof, has been spent by the Government in connection with the administration of the Liquor License Laws. 3. What amount was recovered in fines and penalties under the Liquor License Act, in each of the years 1910, 1911 and 1912. Presented to the Legislature, 12th March, 1913. *Mr. McQueen. Not printed.*

No. 75 Return to an Order of the House of the 11th April, 1912, for a Return of copies of all correspondence between the Government and any Minister or Official thereof with respect to the character, efficiency or teaching in the Schools in Simcoe, Stormont, Prescott, Russell and Glengarry Counties since January 1st, 1910. Of all orders, regulations, provisions or other means authorized or directed by the Government or any member or official thereof, to meet or in consequence of any of the said memorials, resolutions, affidavits, protests, charges or complaints. The schools in the said Counties from which the Provincial grant was withheld in the years 1910 and 1911 respectively. The reports or other evidence upon which grants were paid in 1911 to any schools in the said counties from which grants had been withheld in 1910. Presented to the Legislature, 14th March, 1913. *Mr. Elliott. Not printed.*

No. 76 Return to an Order of the House of the 14th March, 1913, for a Return of copies of: 1. All complaints from any other person or persons received in the years 1911 and 1912 by the Government or any Member of the Government regarding the conduct of Police Magistrate Dempsey. 2. All prosecutions instituted or carried on before Superintendent Rogers as a special magistrate within the Town of Cochrane during the years 1911 and 1912. 3. All protests filed with the Government, with the Prime Minister, the Provincial Secretary, Attorney-General or any other Member of the Government by the corporation of the Town of Cochrane, the Board of Trade or the citizens of the Town of Cochrane against the action of Superintendent Rogers in exercising or assuming to exercise jurisdiction within the Town of Cochrane as a special magistrate. Presented to the Legislature, 14th March, 1913. *Mr. Sinclair. Not printed.*

No. 77 Return to an Order of the House of the 26th February, 1913, for a Return of copies of all correspondence between the Department of Education, the Minister of Education himself, and the Board of Trustees of the Schools of the Village of Plantagenet since the 1st day of March, 1905, up to the 1st day of December, 1908, regarding the Teaching of French. Presented to the Legislature, 17th March, 1913. *Mr. Evanturel. Not printed.*

No. 78 Return to an Order of the House of the 24th February, 1913, for a Return of (1) Copies of the letters referred to on the last page of the brief furnished to the Attorney-General by the Crown Counsel in the proceedings against the Stamped Ware Association, showing offences under the different subsections of Section 520 of the Criminal Code, each incriminating letter being marked *a, b, c,* or *d,* as it discloses an offence against a subsection. The said brief forms part of Return 82, Session 1912. (2) Copies of all correspondence between the Crown Counsel and the Government with reference to prosecution of the said combine and all correspondence containing instructions, if any, from the Government not to prosecute. Presented to the Legislature, 17th March, 1913. *Mr. Elliott. Not printed.*

No. 79 Return to an Order of the House of the 14th March, 1913, for a Return of: (1) A copy of the information, depositions and proceedings before the Police Magistrate of Toronto (including the warrant of commitment) with respect to the members of the Tack Combine who were committed for trial by the Police Magistrate of the City of Toronto. (2) Copies of all correspondence passing between the Attorney-General or any one on his behalf or on behalf of the Government and Mr. Du Vernet, K.C., Crown Counsel, or anyone on his behalf with reference to the trial of the members of the Tack Combine. Presented to the Legislature, 17th March, 1913. *Mr. Rowell. Not printed.*

No. 80 Report on Road Construction under 2 George V. Cap. 2, being Consolidated Revenue Act of Ontario. Presented to the Legislature, 19th March, 1913. *Printed.*

No. 81 Return to an Order of the House of the 12th March, 1913, for a Return showing:—Copies of all correspondence between the Chairman or any other member of the T. & N. O. Railway Commission or any other person on their behalf and any official or employee of the T. & N. O. Railway at North Bay relative to the appointment of W. I. Johnston to his present position with the T. & N. O. Railway at North Bay, Ont. Presented to the Legislature, 19th March, 1913. *Mr. Munro. Not printed.*

No. 82 Report of S. Price *re* limitation of hours of Labour of underground workmen in the Mines of Ontario. Presented to the Legislature, 20th March, 1913. *Printed.*

No. 83 Return to an Order of the House of the 7th March, 1913, for a Return showing:—1. Copy of the information laid against one Stone before the Police Magistrate at Collingwood, in January, 1913, for an alleged violation of the Liquor License Act. 2. Copy of the judgment of the magistrate. Presented to the Legislature, 28th March, 1913. *Mr. Anderson (Bruce.) Not printed.*

No. 84 Return to an Order of the House of the 26th February, 1913, for a Return showing:—1. All expenses incurred by the Hydro-Electric Power Commission, or the Government, or by any person or persons on their behalf, in connection with the passing of the Hydro-Electric By-law at North Bay in January, 1913, or for the purpose of procuring the passage of such By-law, or otherwise connected with the submission of such By-law to the electors of North Bay. 2. The names of all persons employed by the Hydro-Electric Power Commission who were in or visited the Town of North Bay during the months of December or January last, and the purposes for which they were employed in the Town of North Bay, and the amounts that were paid to each of them for their services there. 3. Copies of all correspondence between the Hydro-Electric Power Commission, or the Government, or any person or persons on behalf of the Hydro-Electric Power Commission, or the Government, and the Council of the Town of North Bay, or any person on behalf of the said Council, relating to the Hydro-Electric By-law. Presented to the Legislature, 1st April, 1913. *Mr. Mageau. Not printed.*

No. 85 Further interim Report of the Commissioner on the subject of Compensation to Workmen for Injuries sustained in the course of their employment, together with draft Bill, embodying the Commissioner's conclusions. Presented to the Legislature, 2nd April, 1913. *Printed.*

No. 86 A preliminary study by H. G. Acres, of the Hydro-Electric Power Commission, dealing with the possibility of improving the general regimen and local flow characteristics of the Grand River, by means of Storage and Training Works. Presented to the Legislature, 3rd April, 1913. *Not printed.*

No. 87 Return to an Order of the House for a Return showing:—Copies of all correspondence passing between the Department of Education or the Minister or any official thereof and J. Russell McGregor of Gore Bay (President of the Manitoulin Conservative Association), the Public School Board of Gore Bay, the Public School Inspector in Manitoulin or any other person concerning the granting of a temporary teacher's certificate to one Jean McGregor. 2. A copy of the temporary certificate or temporary certificates granted to the said Jean McGregor. 3. Copy of the Departmental Regulations under which the Minister acted in granting the temporary certificate to the said Jean McGregor. 4. Copies of all advertisements (stating the dates of the same), inserted in any paper or papers prior to the granting of such temporary certificate to Jean McGregor, as required by subsection 2 of section 2 of Circular 30½, dated 7th May, 1912, issued by the Department of Education. 5. The evidence (if any) which the Minister had before him at the time such tem-

porary certificate was granted, that the school board had "taken due measures to obtain a teacher with the prescribed grade of certificate," before the Inspector made his recommendation that Jean McGregor should be granted a temporary certificate. Presented to the Legislature, 4th April, 1913. *Mr. Marshall. Not printed.*

No. 88 A return to an Order of the House of the 21st February, 1913, for a Return showing:—1. All petitions, letters and other documents passing between the British settlers at Jeannette, Kent County, Ontario, and the Premier, the Minister of Agriculture, or any other member of the Government, or any officer or official thereof. 2. All reports by any officer or official of the Government on conditions at Jeannette. 3. All correspondence with the Department of Colonization, the Minister of Agriculture, or any officer or official of the Government in reference to the conditions at Jeannette. Presented to the Legislature, 7th April, 1913. *Mr. Anderson (Bruce.) Not printed.*

No. 89 Return to an Order of the House of the 26th February, 1913, for a Return showing:—1. The number of passes issued by the Timiskaming and Northern Ontario Railway Commission over its line of railway or any part thereof during the period from July 1st, 1911, to 1st July, 1912. 2. The persons to whom the said passes were granted. 3. The purpose for which each of the said passes was granted. Presented to the Legislature, 7th April, 1913. *Mr. Mageau. Not printed.*

No. 90 Return to an Order of the House of the 10th March, 1913, for a Return showing:—1. Copies of the agreements entered into by the members of the following combines and seized by the Toronto Police: (*a*) The Saw Manufacturers' Association: (*b*) The Canadian Churn Manufacturing Association; (*c*) The Hame and Saddlery Hardware Manufacturing Association. 2. Copies of all correspondence between the Attorney-General or any other Member of the Government and any counsel with reference to the prosecution of the said combines. Presented to the Legislature, 8th April, 1913. *Mr. Elliott. Not printed.*

No. 91 Return to an Order of the House of the 2nd April, 1913, for a Return showing:—Copies of all reports received by or in the possession of the Government upon the timber in Algonquin National Park covered by the following agreements:—1. Agreement dated 18th June, 1912, between the Crown and the Bank of Montreal. 2. Agreement dated 15th June, 1912, between the Crown and J. R. Booth. 3. Agreement dated 4th June, 1912, between the Crown and H. Stikeman, General Manager of the Bank of British North America. Presented to the Legislature, 8th April, 1913. *Mr. Marshall. Not printed.*

No. 92 Return to an Order of the House of the 3rd April, 1913, for a Return showing:—The findings of the Grand Jury in the prosecution against the Tack Combine. Presented to the Legislature, 8th April, 1913. *Mr. Sinclair. Not printed.*

No. 93 Return to an Address to His Honour the Lieutenant-Governor of the third day of April, 1913, praying that he will cause to be laid before this House, a Return of copies of all Orders in Council passed during the years 1906, 1907, 1908, 1909, 1910, 1911, 1912, increasing or decreasing the duties payable for tavern or shop licenses in any Provincial or Judicial District or in any municipality or locality situated therein, under authority of 6 Edw. VII., Chap. 47, Sec. 10 (1), and showing in respect to every such Order in Council: (*a*) the date of the same, (*b*) the name of the person holding the shop or tavern license affected by the said Order in Council, (*c*) the place where such shop or tavern license was held, (*d*) the amount of license fee as fixed by such Order in Council, (*e*) the amount of the license fee previous to such increase. Presented to the Legislature, 8th April, 1913. *Mr. Anderson (Bruce.) Not printed.*

No. 94 Return to an Order of the House of the 14th March, 1913, for a Return showing:—1. The number of instruments registered in each of the years 1909, 1910, and 1911, in the Land Titles Office, at Toronto. 2. The total amount of fees received in each of the said years. 3. The total amount of disbursements for each such year. 4. The amount of the Guarantee Fund. 5. The total losses. 6. The number of Plans of sub-division. Presented to the Legislature, 9th April, 1913. *Mr. Proudfoot. Not printed.*

No. 95 Copies of Orders-in-Council in accordance with the provisions of subsection 6 of section 78 of the Surrogate Courts Act. Presented to the Legislature, 14th April, 1913. *Not printed.*

No. 96 Copy of an Order in Council approved by His Honour the Lieutenant-Governor, the 3rd day of April, A.D. 1913, approving of the accompanying regulation, being a regulation of the Provincial Board of Health, for the control of Communicable Diseases under the provisions of the Public Health Act, Chapter 58, 2 George V. Also Regulations of the Provincial Board of Health, Ontario, approved by His Honour the Lieutenant-Governor in Council on the 10th day of August, 1912. Presented to the Legislature, 14th April, 1913. *Not printed.*

No. 97 Return to an Order of the House of the 19th February, 1913, for a Return showing:—1. The names of all Counsel retained on behalf of the Crown at any criminal assize in the Province during the year ending 31st December, 1912. 2. The Assize at which each Counsel was so retained. 3. The amount paid

to every such Counsel for services rendered to the Crown at every such assize. 4. The names of all Solicitors or Counsel employed or retained by the Crown for any other purposes during the year ending 31st December, 1912, showing:—(*a*) The amount paid to every such Solicitor or Counsel. (*b*) The matter in respect of which such Counsel or Solicitor was so employed or retained. 5. The total amounts paid to Counsel for the Crown in criminal or other proceedings for the years 1910, 1911 and 1912. Presented to the Legislature, 14th April, 1913. *Mr. Richardson. Not printed.*

No. 98 Return to an Order of the House of the 9th April, 1913, for a Return showing:—1. Copies of all correspondence during the past year between the Minister of Agriculture or any other member or official of the Government and N. B. Colcock (formerly employed in the London Office of the Colonization and Emigration Branch) relating to the reorganization of the London Office, to the staff thereof, or to the resignation of the said Colcock, or to his dismissal from office, or to his retirement from the service of the Government, or to any other matters connected therewith. 2. Copies of all correspondence during the last year between the Minister of Agriculture or any other member or official of the Government and any other person or persons relating to the matters aforesaid. Presented to the Legislature, 15th April, 1913. *Mr. Anderson (Bruce.) Not printed.*

No. 99 Return to an Order of the House of the 15th April, 1913, for a Return showing:—Copies of all reports received by the Government and other information in the possession of the Government: 1. In reference to the general character of the country through which the projected line of the Bruce Mines and Algoma Railroad runs, and of the lands proposed to be granted to the said railway. 2. In reference to the extent and character of the different classes of timber on said lands. 3. In reference to the extent and character of the agricultural lands within the said areas. 4. In reference to the portion of the Mississagi Forest Reserve through which the projected line will pass and the effect that the construction of the said line will have upon the timber in the said Reserve. 5. The estimated length of the said line and the total estimated area of land to be granted to the said railway company. 6. In reference to the surveys already made, and the probable route of the said railway. 7. The names of the parties at present interested in or owning the said railway and who are responsible for its promotion with full information as to their business occupation and financial standing. 8. The character of the plants, mills or other industries upon which the railway undertakes to expend $3,500,000 and the site or sites where it is proposed to locate the same; and if the parties now interested in the railway are the parties who

are to control the industries proposed to be established. Presented to the Legislature, 17th April, 1913. *Mr. Atkinson. Not printed.*

No. 100 Copies of Orders in Council approved by His Honour the Lieutenant-Governor the 12th day of April, A.D. 1913, appointing John Donnelly, Esquire, one of the Governors of the School of Mining, Kingston, in the room and stead of H. W. Richardson, resigned, and Agreements made between the Canada Publishing Company and His Majesty the King, respecting the right to print, publish and supply the Ontario High School English Grammar, and the Ontario High School Reader; also, an Agreement between the Copp, Clark Company, Ltd., and His Majesty the King, respecting the right to print, publish and supply the Ontario High School Reader. Presented to the Legislature, 18th April, 1913. *Not printed.*

No. 101 Return to an Order of the House of the 2nd April, 1913, for a Return showing:—All tavern and shop licenses, the renewal of which has been prohibited by the Provincial Secretary under Section 23 of 6 Edward VII., Chapter 47, as amended by Section 13 of 1 George V. Chap. 64. Presented to the Legislature, 18th April, 1913. *Mr. Proudfoot. Not printed.*

No. 102 Return to an Order of the House of the 27th March, 1913, for a Return showing:—Copies of all licenses or permits granted by the Game and Fisheries Department to the Dominion Fish Company, or to any person on its behalf during the seasons 1910, 1911 and 1912. Presented to the Legislature, 18th April, 1913. *Mr. Clarke. Not printed.*

No. 103 Return to an Order of the House of the 9th April, 1913, for a Return showing:—1. All correspondence between any member or official of the Government or any other person or persons, relating to the application of one John Lapointe of Spanish, for a renewal of his fishery license for the years 1911 and 1912. 2. Any reports or recommendations relating to the matter made by any official of the Game and Fisheries Department. Presented to the Legislature, 18th April, 1913. *Mr. Clarke. Not printed.*

No. 104 Return to an Order of the House of the 10th March, 1913, for a Return showing:—(*a*) Copies of all correspondence between any official of the Government and the Standard Insurance Company during the years 1907, 1908 and 1909. (*b*) A copy of any Reports made by the Inspector who inspected the books of the Standard Insurance Company during the same years. (*c*) Copies of all correspondence between any official of the Government and the Liquidator of the Standard Insurance Company. Presented to the Legislature, 18th April, 1913. *Mr. Elliott. Not printed.*

No. 105 Return to an Order of the House of the 19th February, 1913, for a Return showing:—1. All presentments made by Grand Juries within the Province of Ontario during the year ending 31st December, 1912, stating the assize at which each presentment was made and the date. Presented to the Legislature, 18th April, 1913. *Mr. Sinclair. Not printed.*

No. 106 Return to an Order of the House of the 26th February, 1913, for a Return showing:—1. The amount of money expended directly by the Government in each of the years 1911 and 1912, in the construction or repair of (*a*) roads; (*b*) bridges, and (*c*) drains in each of the Districts of Sudbury, Nipissing, Parry Sound and Sturgeon Falls, distinguishing the amount spent in each of said Districts for each of said purposes. 2. The amount of money expended during 1911 and 1912, by the Government by way of aid to any municipalities in the said Districts in the construction or repair of roads, bridges or drains, stating in respect to each work which was undertaken with Government aid as aforesaid. (*a*) The purpose of the work, that is, whether for roads, bridges or drains, and whether for construction or repair. (*b*) The District in which such work was undertaken. (*c*) The amount expended by the Government on such work. (*d*) The amount expended by the municipality on such work. Presented to the Legislature, 18th April, 1913. *Mr. Mageau. Not printed.*

No. 107 Return to an Order of the House of the 27th February, 1913, for a Return of:—1. Copies of all correspondence during the years 1910 and 1911 between the Minister of Lands, Forests and Mines, or any other member of the Government, and the Imperial Paper Mills Company, or the Liquidator or Interim Liquidator of the Imperial Paper Mills with reference to the diversion of water from Lake Temagimi into the Montreal River. 2. Copies of all correspondence passing during the years 1910 and 1911 between the Minister of Lands, Forests and Mines or any other member of the Government, and the Council of the Town of Sturgeon Falls, or any official or any other person on behalf of the Town of Sturgeon Falls, or the Board of Trade of the Town of Sturgeon Falls, or any person on behalf of the said Board of Trade. 3. How many cubic feet of water per second have been diverted from Lake Temagimi into the Montreal River, and what is the available head of water, and what is the horse power. Presented to the Legislature, 21st April, 1913. *Mr. Mageau. Not printed.*

No. 108 Statement of distribution of Revised and Sessional Statutes for the year 1912. *Not printed.*

No. 109 Return to an Order of the House of the 10th March, 1913, for a Return showing copies of the resolutions (if any) adopted at the Board Meeting held at the Horticultural Experiment Station at Jordan Harbour on or about December 17th last. Pre-

sented to the Legislature, 23rd April, 1913. *Mr. Anderson (Bruce.) Not printed.*

No. 110 Return to an Order of the House of the 27th March, 1913, for a Return showing:—1. Copy of an Order in Council dated the 23rd April, 1910, reducing the royalty payable to the T. & N. O. Railway by the Right of Way Mining Company. 2. Copy of an Order in Council dated 17th December, 1912, further reducing the royalty payable by the Right of Way Mining Company to the T. & N. O. Railway. 3. Copy of an Order in Council dated December 14th, 1909, reducing the royalty payable by the Cobalt Townsite Mining Company to the T. & N. O. Railway. 4. Copy of an Order in Council dated December 17th, 1912, further reducing the royalty payable by the Cobalt Townsite Mining Company to the T. & N. O. Railway. 5. Copy of an Order in Council dated December, 14th, 1909, reducing the royalty payable by the City of Cobalt Mining Company to the T. & N. O. Railway. 6. Copy of an Order in Council dated December 23rd, 1912, further reducing the royalty payable by the City of Cobalt Mining Company to the T. & N. O. Railway. 7. Copy of an Order in Council dated December 14th, 1909, reducing the royalty payable by the Nancy-Helen Mines, Limited, to the T. & N. O. Railway. 8. Copy of an Order in Council dated December 17th, 1912, further reducing the royalty payable by the Nancy-Helen Mines, Limited, to the T. & N. O. Railway. 9. Copy of an Order in Council dated December 14th, 1909, reducing the royalty payable by the Wright Silver Mining Co., to the T. & N. O. Railway. 10. Copy of an Order in Council dated December 17th, 1912, further reducing the royalty payable by the Wright Silver Mining Co., to the T. & N. O. Railway. 11. Copy of an Order in Council dated December 14th, 1909, reducing the royalty payable by the Railway Reserve Mines, Limited, Jack Pot Silver Mining Company, Ontario Development and Mining Company, and Station Grounds Mining Company, to the T. & N. O. Railway. 12. Copy of an Order in Council dated December 17th, 1912, further reducing the royalty payable by the Railway Reserve Mines, Limited, Jack Pot Silver Mining Co., Ontario Development and Mining Company and Station Grounds Mining Company, to the T. & N. O. Railway. 13. Copy of an Order in Council or agreement reducing the royalty payable by the O'Brien Mine to the Crown. 14. Copy of Order in Council or agreement, further reducing the royalty payable by the Chambers-Ferland Mining Company from 25 *per cent.* of value of ore at pit's mouth, less surface charges, to 25 *per cent.* of net profits. 15. Copy of agreement dated 8th October, 1912, exempting Chambers-Ferland Mining Company from royalty, unless on rich ore being found, when rate of 25 *per cent.* on net profits made to be imposed. Presented to the Legislature, 23rd April, 1913. *Mr. McDonald. Not printed.*

No. 111 Return to an Order of the House of the 26th February, 1913, for a Return shewing:—1. Copies of all correspondence and other papers, documents, etc., seized by the Crown in connection with the prosecution of the Canadian Washing Machine Manufacturing Association. 2. Copies of all correspondence between the Government or any member or official of the Government and any other person or persons relating to the Canadian Washing Machine Manufacturing Association, or the prosecution thereof, or the discontinuance of such prosecution. 3. Copies of all correspondence and other papers, documents, etc., seized by the Crown in connection with the prosecution of the Canadian Clothes Wringer Manufacturing Association. 4. Copies of all correspondence between the Government, or any member or official of the Government, and any other person or persons, relating to the Canadian Clothes Wringer Manufacturing Association, or the prosecution thereof, or the discontinuance of such prosecution. Presented to the Legislature, 23rd April, 1913. *Mr. Sinclair. Not printed.*

No. 112 Return to an Order of the House of the 14th March, 1913, for a Return showing:—For the year 1912. 1. The number of cases in which damage suits were entered in Court against the employer. 2. The number of instances where damages were obtained and the amounts. 3. The number of cases non-suited by the Court. 4. The number of cases where employers settled by paying compensation without damage suit and the amounts. Presented to the Legislature, 7th May, 1913. *Mr. McQueen. Not printed.*

No. 113 Return to an Order of the House of the 27th March, 1913, for a Return showing:—1. The names of the professors of the Faculty of Education (not including instructors in practice schools) at (*a*), Toronto University; (*b*), Queen's University. 2. The number of hours teaching done by each of said professors *per* week. 3. The number of students in attendance in the Faculty of Education during the Session 1912-1913, at (*a*), Toronto University; (*b*), Queen's University. 4.The average cost *per* pupil in the Faculty of Education during each of the last five years at (*a*), Toronto University; (*b*), Queen's University. 5. The number of extra-mural students under instruction by the Faculty of Education at (*a*), Toronto; (*b*), Queen's. 6. The number of hours of instruction *per* session given in each of the following subjects of the course of study in education:—(*a*) History of Education and Educational systems; (*b*) Principles of Education; (*c*) Psychology and General method; (*d*) School management and school law; (*e*) Methods in Public School subjects; (*f*) Methods in High School subjects; (*g*) Art work; (*h*) Commercial work and writing; (*i*) Constructive work; (*j*) Household science; (*k*) Nature study; (*l*) Music; (*m*) Physical training; (*n*) Physiology and Hygiene, including treatment of emergencies. Presented to the Legislature, 7th May, 1913. *Mr. Marshall. Not printed.*

REPORT

OF THE

Minister of Agriculture

PROVINCE OF ONTARIO

FOR THE YEAR ENDING
OCTOBER 31, 1912

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO:
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1913

Typical scene on an Ontario farm in harvest time.

REPORT

OF THE

Minister of Agriculture

1912

To the Honorable Sir John Morison Gibson, K.C.M.G.,
Lieutenant-Governor of the Province of Ontario.

May It Please Your Honour:

I have the honour to submit the Annual Report of the Department for the fiscal year ending October 31, 1912.

Before reviewing in some detail the work of the Department in its various branches, I beg to refer to two matters of much interest and importance to agriculture in this Province. The first is the matter of Federal financial aid. For some time past it has been urged by this Government that the Federal Government might very properly grant financial assistance to the carrying on of several lines of work through provincial organizations, such as agriculture, good roads, immigration. It was, therefore, a matter of gratification when, at the last session of the Dominion Parliament, the Federal Minister of Agriculture announced a temporary measure of this nature as far as agriculture was concerned, to be accompanied by a careful and authoritative enquiry with a view to the adoption of a permanent plan. The sum of $500,000 was set apart to be divided among the various provinces on the basis of population. Of this Ontario received the sum of $175,000, and it is a pleasure to acknowledge the hearty co-operation and assistance of the Federal Minister in the handling of this grant. In accordance with the legislative enactments of the Dominion and the Province, an agreement was entered into setting forth the purposes for which and the conditions under which the money could be expended. These conditions were, of course, only of a general nature. The plan of expenditure was drawn up by this Department and met with prompt approval of the Federal Minister as follows:

Field Husbandry Building, Ontario Agricultural College	$40,000 00
District Representatives	21,000 00
Poultry Work	10,000 00
Milking Shorthorns	12,500 00
Fruit Work	9,000 00
Short Courses	7,000 00
Eastern Ontario Live Stock Buildings	10,000 00
Special Grants for Agricultural Exhibition Buildings	10,000 00
Agricultural Work in connection with Public Schools, including School Gardens, Seed Displays, etc.	10,000 00
Drainage Work	5,000 00
Live Stock in Northern Ontario	5,000 00
Women's Institutes	3,500 00
Dairy Survey	2,000 00
Western Ontario Creamery Work	1,500 00
Soil Survey	500 00
Miscellaneous Work	3,733 00
Ontario Veterinary College (additional land)	25,000 00

First official threshing in Ontario by Hydro-Electric power.

The work was promptly proceeded with, but, of course, it will extend considerably beyond the fiscal year. For instance, the plan to purchase Milking Shorthorns in England was interfered with by an outbreak of foot and mouth disease in Great Britain and the consequent prohibition of export. This will therefore have to wait until next summer.

There are many indications that the expenditure along the lines indicated is much appreciated and is productive of much benefit. Its success fully warrants the adoption of a permanent plan of a similar nature, and in response to the request of the Federal Investigating Commissioner, Mr. C. C. James, C.M.G., I have taken occasion to make representations to this end. To be effective in work of this kind it is necessary to get as close as possible to the people, and Ontario now has a splendid agricultural organization for this purpose. Inasmuch as the resources of the

Many uses for electricity on Ontario farms.

Dominion treasury would seem to justify greatly increased aid for agricultural instruction, I am satisfied efficiency will be attained and duplication avoided by utilizing the existing provincial organization for this purpose, as well as by developing the Federal Department on what may be described as less local lines. I am sure Ontario will be glad to co-operate in any permanent plan which may be adopted along these lines.

The other subject to which I would refer is the matter of electricity on the farm. While this subject very properly comes under the administration of the Hydro-Electric Commission, which handles all matters pertaining to electricity, it is a matter in which this Department takes a keen interest. During the past few months a number of demonstrations have been given on farms in Western Ontario with a view to showing the possibilities of electricity as applied to agri-

culture. I had the pleasure of attending the first of these, held on a farm in Toronto Township in Peel County, when for the first time on an ordinary Ontario farm electricity was the motive power propelling a threshing machine. Demonstrations were also given in sawing, pumping, grinding, operating a cream separator and a churn, as well as the many items of household practice, such as ironing, washing, cooking, toasting, etc. These demonstrations attracted great interest, and showed conclusively the efficiency of electricity as a labor saver. There are a great many details to be taken into consideration, but it is the plan of the Commission to deliver electricity to the farmers in the electric zone—which is being extended in area year by year—on an absolutely cost basis, and if this is found to be within the reach of those who live in the rural districts there is no doubt of the popularity and usefulness of electricity on the farm.

I beg to direct the attention to the work of the Department as carried on through its various branches.

ONTARIO AGRICULTURAL COLLEGE.

Aside from its continued success as a medium of instruction, the College has enjoyed notable expansion during the past year. This expansion included both land and buildings. Early in the year arrangements were completed for the purchase of 150 acres of adjoining land. Of this, 10 acres will be used for building up a commercial orchard which is to be planted out in the spring, 25 acres will be handled by the Department of Field Husbandry in connection with the experimental work, while the balance will be under the Farm Department and will be used chiefly for the growing of field crops for feeding purposes. In the matter of buildings a modern new dairy barn has been erected and good progress has been made on a new field husbandry building which it is hoped will materially improve the facilities for experimental work and will also provide needed class accommodation, especially for Short Courses. Plans have been prepared and preliminary arrangements made for the erection of a new dining hall, and it is expected work will be started in the spring.

ATTENDANCE FOR THE YEAR.

The following figures give the attendance for the year:

General Course	492	
Specialists in General Course Work	8	
Manual Training (One Year Normal Course)	7	
Teachers' Courses (Agriculture and Horticulture, 46, Industrial Arts, 5)	51	
Dairy Courses	54	
Stock and Seed Judging	192	
Poultry Raising	38	
Fruit Growing	169	
Apiculture	44	
		1,055
MACDONALD INSTITUTE.		
Domestic Science	236	
Nature Study (79), Elementary Agriculture and Horticulture (28), Woodwork and Mechanical Drawing (13), Art and Constructive Work (40)	160	
		396
Total		1,451

Of the 492 boys taking the general course at the College, 356 were Ontario boys, 70 from other Provinces of the Dominion, and 66 from seventeen other countries, including 22 from England and 17 from the United States. I may add that a class of about 50 received the B.S.A. degree from Toronto University, and many were at once in demand in teaching or government service. A number went back to the farm, as did also practically all the other students who took courses at the College. It is safe to say that at least 95 per cent. of the students who take courses at the College, long or short, return to the farm.

During the month of June the College was visited by between 15,000 and 20,000 farmers from all parts of the Province. They were shown through all the departments, and over the experimental plots, and spent a very educational day. The attendance, while large, was not as large as in some previous years, owing to changes in railway rates and accommodation.

RESULTS FROM CROP EXPERIMENTS.

In addition to the work of instruction, the College renders a distinct service to the agriculture of the Province by means of its experimental work, especially that pertaining to farm crops. In this connection it may be pointed out that the growing season of 1912 was one of the most remarkable in the history of the Province because of the excessive rainfall, especially following after 1911, which was almost equally remarkable for drought. Below the figures compiled by the Physics Department are given, and although taken at the College are, no doubt, fairly typical of conditions throughout the Province. They show unusually heavy downfalls in May, when it seriously interfered with the seeding, and in August when harvesting operations were in progress. In fact, in many parts of the Province farmers were unable to finish harvesting until well on in October or November. The following figures, however, will be of interest:

INCHES OF PRECIPITATION DURING THE SIX GROWING MONTHS.

Month.	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	Average, 13 Years.
April	1.69	2.24	2.43	2.69	2.10	1.82	1.44	1.66	1.33	3.60	3.13	1.67	1.14	2.07
May	1.03	3.26	1.67	2.44	3.01	3.89	2.71	2.64	3.47	3.43	2.75	1.64	5.64	2.89
June	4.47	1.53	3.06	3.05	2.86	3.24	4.06	1.11	3.21	1.33	.78	.89	1.51	2.39
July	3.05	4.07	6.43	2.67	4.99	4.60	4.65	1.92	3.25	4.54	1.89	1.95	2.53	3.58
August	.87	3.51	2.18	3.47	3.88	1.98	2.13	.62	2.75	.89	3.18	2.53	6.07	2.62
September	1.52	2.45	3.58	1.48	2.80	2.85	2.49	2.87	.73	.86	3.29	3.42	3.08	2.42
Totals	12.63	17.06	19.35	15.80	19.64	18.38	17.48	10.82	14.74	14.65	15.02	12.10	19.97	15.97

Experiments were continued on some 2,000 plots and in conjunction with the members of the Experimental Union who carried on co-operative experiments on their own farms. The growth of the latter is shown by the following figures:

Five Year Period.	Average Number of Experimenters per annum.
1886—1890	71
1891—1895	1,060
1896—1900	2,992
1901—1905	3,379
1906—1910	4,278
1911	4,490
1912	5,027

An exhaustive statement of the results of crop experiments is given by the Professor of Field Husbandry, among the points brought out being the following:

As to the question of the change of seed from one soil on one locality to another, it has been found that it is quite possible to grow the same varieties for a considerable length of time without change of seed, providing care is taken in the selection of the seed and in the growing of the crop.

The following rotation is adopted on the experimental area: First year grain, second year cultivated crops, third year grain, fourth year pasture. On the farm proper there is a four year rotation also: First year cultivated crops, second year grain, third and fourth years hay and pasture. Crops following clover sod show an increased yield of 44.7 per cent. over those following timothy sod.

An Ontario farm home where it is not all work.

Extensive experiments show that large plump seed gives a considerably greater yield per acre than small plump, shrunken, or broken seed. In 1912 the yield per acre of large plump oats was 74 bushels, and from light seed of the same variety only 53.9 bushels. Similar striking results were secured in root tests.

In treatments for loose smut in oats and stinking smut in wheat it was found the greatest yield per acre was produced from grain which was immersed in a solution made by adding one pint of formalin to 42 gallons of water for a period of twenty minutes.

O. A. C. No. 21 barley developed at the College from Mandscheuri is now taking practically all the prizes in competitions, and its popularity is spreading rapidly over the Province. O. A. C. No. 72, which is now being further experimented with, promises to duplicate the success of O. A. C. No. 21 barley.

Dawson's Golden Chaff, the most extensive variety of winter wheat grown in Ontario, has given the highest yield per acre of the fourteen varieties grown at the College in the last seventeen years.

After testing seventeen crops separately and six combinations within the last seventeen years, the following mixture is recommended where a pasture is desired the same season:

Oats	51	lbs.	per	acre.
Early Amber Sugar Cane	30	"	"	"
Common Red Clover	7	"	"	"
Total	88	"	"	"

Important results have been secured with alfalfa, showing that it is essential to grow a hardy strain in Ontario, and one of the best is the Ontario Variegated Alfalfa, originated in Haldimand County. Many of the failures have been due to the use of seed from milder Southern States, and unfortunately this has been imported into Ontario in large quantities. The crop of alfalfa seed was practically a failure last season, but it is hoped to make this an important industry in the future.

RESULTS IN FIGHTING BOVINE TUBERCULOSIS.

During the past three years the Animal Husbandry Department has been fighting tuberculosis in both beef and dairy cattle, and interesting results have now been secured. The plan adopted has been what is known as the Bang system, a system introduced by Prof. Bang of Denmark, by which calves at birth are taken from the mother, raised on milk either pasteurized or from healthy cows, and reared in a separate building, as it is well known that tuberculosis is contagious but not hereditary.

When the College herd was tested in 1909 there were 37 animals in the beef section and 30 in the dairy. Of the 37 in the beef herd, 14 gave no reaction, 18 reacted, and 5 were doubtful, three of the latter reacting later. Of the 30 dairy animals, 21 reacted on the first test and five on later tests, leaving only 4 as the basis of the clean herd. Fourteen of the reactors were slaughtered during the three years, 12 being still in the quarantine stable. In the clean herd there are now after three years 25 heifers and young cows which have successfully withstood the test every time, and, of these 25, 22 had tubercular mothers. In addition to the regular application of the test and the policy of segregation, careful attention has been paid to sanitation, even to the extent of having separate attendants look after each herd. The results clearly show the efficiency of this method in cleaning up a herd. One striking example of this may be cited: Two cows, one in the clean stable and one in the tubercular stable, had calves in October and November respectively. The calf from the tubercular cow was taken to the clean stable and fed on milk from healthy cows. The healthy cow's calf was put on a tubercular cow and isolated in a roomy shed. The calf with the healthy mother but tubercular foster mother reacted to the first test. The calf with the tubercular mother but healthy foster mother has stood the test three times.

This is a brief review of an effort to deal with a serious problem and should be closely studied by all engaged in the bovine industry.

DRAINAGE WORK CONTINUES.

The campaign for assisting and encouraging farmers in laying tile drains has continued with ever increasing success and usefulness. The following figures show the progress of the work since the beginning:

Year.	Applications.	Surveys.	Applications held over.	Acres Surveyed.	Miles of Drain.	No. of Demonstrations.	Average Attendance.
1906.....	15	15	.....	500	45	.....	.....
1907.....	126	70	56	3,500	350	.....	.....
1908.....	166	100	66	5,000	510	43	.....
1909.....	302	179	121	5,157	613	48	18.0
1910.....	418	383	135	14,672	1,800	132	23.6
1911.....	514	327	87	15,211	1.864	142	17.4
1912.....	430	293	137	17,212	2,278	70	21.7
Totals.....	.....	1,367	.....	61,252	7,460	435	.....

A Drainage Demonstration.

This work has been carried on by the staff of the Physics Department of the College in co-operation with District Representatives. In addition, however, to the regular work during the past year some special experiments have been undertaken. These are planned to demonstrate the possibilities in sections where drainage has not been attempted heretofore. A field of ten to twelve acres is taken over, conveniently situated on a main road so that it will attract the attention of as many farmers as possible. The Department digs the drains and lays the tile in half of the field, holding a public demonstration in so doing. The owner provides the tile, boards the men handling the ditching machine, agrees to leave the other half undrained for three crops, sow both halves to the same crop, and report results. A demonstration of this kind was held in Bruce County last fall, and plots have been arranged for in Haldimand County for the coming year. Other plots will be taken over in Eastern Ontario.

CHANGES IN FORESTRY WORK.

During the past season about 350,000 plants were sent out for experimental planting, bringing the total distributed through this Department up to two mil-

lions. In this distribution almost every county is now represented. Collections of forest seedlings have been sent to many of the schools through the Schools' Branch of the Experimental Union.

The forest nursery in Norfolk County continues to make good progress and now contains about 980,000 plants in nursery lines as follows:

White Pine	350,000
Scotch Pine	325,000
Larch	80,000
White Cedar	25,000
Black Locust	75,000
Black Walnut	25,000
Butternut	15,000
Chestnut	25,000
Soft Maple	15,000
Elm	10,000
White Ash	10,000
Miscellaneous	25,000

and about 500,000 seedlings in seed beds as follows:

White Pine	25,000
Norway Pine	100,000
White Cedar	10,000
Larch	10,000
White Spruce	50,000
Yellow Pine	25,000
Miscellaneous	30,000

An important change in the administration of forestry work has just been made. The Professor of Forestry has been appointed Forester for the Department of Lands, Forests and Mines, and will henceforward handle the work from that Department in conjunction with other important duties in regard to the timber resources of the Province. Lectures in forestry will, however, continue to form a part of the College curriculum and the experimental distribution will be made as usual.

MORE POULTRY EQUIPMENT.

The Poultry Department has been further strengthened by the erection of a new breeding house over 200 feet long and containing thirty-two pens, and by the purchase of a new incubator with a capacity for 3,000 eggs. With the aid of the former it is intended to carry on experiments as to the laying power of the offspring of a larger number of males, as it is believed egg production is largely hereditary through the male.

The severe weather which characterized last winter seemed to affect the hatching power of the eggs and the results were consequently not so good. Very favorable reports have been received, however, as to the bred-to-lay strains which have been distributed from the College.

Experiments have been carried on in the feeding of Buff Orpingtons, Rhode Island Reds and White Leghorns, the feeds being buttermilk, 10 per cent. dry mash, beef scrap, beef scrap in hopper, no animal food, green cut bone. The Department reached the following general conclusions:

With all three breeds buttermilk produced the most and the cheapest eggs.

Where beef scrap was fed in a hopper or where the birds could eat all they desired the Leghorns and Rhode Island Reds did much better than the Orpingtons.

No animal food in all instances gave the best eggs for hatching and the lowest egg yield.

From the results so far obtained it would appear to be a disastrous practice to undertake feeding Leghorns on no meat food ration, or meat food in very small quantities, for the reason that they developed feather eating to such an extent that some of the birds were killed and the males were a sorry sight, in fact had to be frequently removed from the pen. This was true to a limited extent with the Rhode Island Reds, but was not so of the Orpingtons.

GROWING INTEREST IN BEEKEEPING.

The Apiculture Department has developed a great interest in beekeeping, one evidence of which was the attendance of between 40 and 50 at the two weeks' Short Course. Another evidence was the success of the extension work directed by this Department. Working in conjunction with district representatives, new Beekeepers' Associations were formed in the Counties of Elgin, Prince Edward,

Great interest is being developed by Apiary demonstrations.

and Grey, making a total of twenty local associations in affiliation with the Ontario Association, which has a membership of 600. Over fifty Apiary Demonstrations were held throughout the Province, with an average attendance of twenty-six. Good results were secured from the College apiary, as well as the apiary of the Horticultural Experiment Station at Vineland.

WORK OF ANALYSIS.

The work of the Department of Chemistry in analysing samples sent in from outside is indicated by the following figures:

Soils	49
Fertilizers	29
Cattle Feeds	28
Human Foods	10
Water	27
Insecticides and Fungicides	12
Miscellaneous	39
Total	194

Samples of soils sent in are frequently accompanied by a poverty of information as to the local conditions, etc., which makes a chemical analysis of small value. The well water samples received continue to indicate a large percentage of waters which are not fit for domestic use. A Bulletin will be issued on this subject in the near future. Experiments have also been carried on to determine the milling and baking value of certain wheats.

SEED INOCULATION.

The Bacteriological Department has continued the work of distributing bacteria cultures for the purpose of seed inoculation. Altogether 4,722 cultures were sent out, each sufficient for one bushel of seed. Of these, 3,898 were for alfalfa, 570 for red clover, the remaining 254 being divided among alsike clover, white clover, peas, beans, vetches and sweet peas. The wide attention which this work has attracted is indicated by the fact that 132 cultures for alfalfa were sent to Alberta and 162 to British Columbia. Reports received in return show a decided benefit from inoculation in 62.1 per cent. of the cases.

STERILIZING SOIL FOR VEGETABLES.

In the Vegetable Gardening Branch of the Pomological Department some new experiments were conducted in the sterilization of the soil. A steam outfit for sterilizing greenhouse soil was installed last spring and tomatoes were selected for the test. The following figures show the results of partial sterilization:

140 plants sterilized produced 936.6 lbs. fruit=6.69 per plant.
40 plants unsterilized produced 176.9 lbs. fruit=4.42 per plant.

The unsterilized soil contained 1,600,000 bacteria per cc., including many injurious, while the sterilized soil at the depth of two inches contained only 900 per cc., mostly beneficial.

ONTARIO VETERINARY COLLEGE.

With a total registration of 367, the College has continued to make satisfactory progress during the year.

The number of students in the first year class at the close of the year was 99, as against 94 the previous year, while the number registered at the opening of the year was 269 as against 258 the previous year.

A number of changes have been made in the course of study with amplification in some lines of teaching, there being in all 22 teachers now on the staff. The efficiency of the course is indicated by the fact that the forty students who tried the Dominion Civil Service examination all passed, while other students were equally successful in examinations before other outside Examining Boards. Many enquiries for men, both in general practice and in special lines, indicate a healthy state in the profession and a bright future for graduates.

As there has been some misapprehension on the subject, it may be well to point out that only graduates of this College are legally entitled to practise in Ontario. The Act at present provides that anyone who does not possess a diploma of the Ontario Veterinary College who appends to his name the term veterinary surgeon or any abbreviation thereof, or who wilfully and falsely pretends to be or who wilfully and falsely takes or uses any name, title, addition, abbreviation or description implying or calculated to lead people to infer that he is or is recognized by law as a veterinary is subject to a penalty of not more than $100 and not less than $25. Some prosecutions were made during the past year under this Clause and convictions secured. The Act at present does not even provide for the recognition of graduates of other Veterinary Colleges of standing, but some provision of this nature should be made in the near future.

BUREAU OF INDUSTRIES.

Again there has been an increased demand for the publications of the Department distributed by this branch, which also collects and compiles agricultural and municipal statistics. The figures follow:

193	Tuberculosis of Fowls	36,000
194	Apple Orcharding	40,000
195	Insecticides and Fungicides (No. 154 revised)	10,000
196	Tomatoes	6,000
197	Bee Diseases in Ontario	11,000
198	Lime-Sulphur Wash	12,000
199	Onions	6,000
200	Fruit Juices	6,000
201	Peach Growing in Ontario Peach Diseases	6,000
202	Grape Growing in Niagara Peninsula	6,000
203	Cabbage and Cauliflower	6,000
204	Decay of the Teeth	35,000
205	Dairy School Bulletin I. Cheese-making and Butter-making.	12,000
206	Dairy School Bulletin II. Dairying on the Farm.	35,000
		227,000

The following crop and statistical bulletins have been distributed:

Crop Bulletin 109, November, 1911	15,000
Crop Bulletin 110, April, 1912	6,000
Crop Bulletin 111, May, 1912	6,000
Crop Bulletin 112, August, 1912	6,000
Municipal Bulletin No. 6	6,000

These figures, of course, do not show the number of bulletins issued in previous years, for which there is still a big demand. The advantage of the bulletin is that it deals in a concise, authoritative way with practical subjects. A good distribution is also made of the larger reports, which contain many valuable articles. Following are the figures for the past year:—

Minister's Report	25,000
The Ontario Agricultural College	30,000
The Experimental Union	28,000
The Ontario Veterinary College	4,000
Agricultural Societies and Field Crop Competitions	20,000
Horticultural Societies	15,000
Vegetable Growers' Associations	8,000
Live Stock Associations	30,000
Farmers' Clubs	5,000
Farmers' Institutes, II.	4,000
Women's Institutes, I. and II.	32,000
Dairymen's Associations	28,000
Entomological Society	3,000
Fruit Growers' Association	4,000
Fruit Branch	8,000
Ontario Corn Growers' Association	6,000
Beekeepers' Association	3,000
Bureau of Industries (Agricultural Statistics)	7,000
Bureau of Industries (Municipal Statistics)	6,500
	266,500

AGRICULTURAL SOCIETIES BRANCH.

The feature of the work of this Branch during the past year was the large increase in the number of societies taking part in the Standing Field Crop Competition. In spite of the fact that the very unseasonable weather prevented a large number from carrying out their purpose to conduct a competition, 153 societies actually held competitions. This included 3,000 individual farmers and 30,000 acres. The growth of this work as shown by the following figures is illuminating:

	Societies.	Competitors.	Acres.
1907	10	325	300
1908	46	650	600
1909	77	1,200	20,000
1910	110	1,650	26,000
1911	104	1,800	28,000
1912	153	3,000	30,000

Young men under guidance of a District Representative taking part in a Stock Judging Competition at the fall fair.

For the encouragement of this work the grant by the Department was increased during the past year from $30 to $50 per society and to this the societies added $25. Oats was the most popular crop for competitive entry, accounting for 100 entries, the balance being made up as follows: 14 potatoes, 9 barley, 8 fall wheat, 4 spring wheat, 1 peas, 1 red clover. Ninety judges were sent out and incidentally did valuable educational work in pointing out methods of cultivation, weed eradication, etc. Prize-winning grain also competed at large exhibitions at Toronto and Ottawa.

The regular work of the Agricultural Societies continued with increased interest. The attendance at the various fall fairs throughout the Province is reported as larger than ever. In many instances new permanent buildings have

been erected. Many societies hold stock and seed fairs, while a number availed themselves of the provisions of the Act granting encouragement for pure-bred stock, one society receiving as much as $650 for this purpose.

Then too the provision for rainy weather insurance has proven a great boon to many societies which suffered from unfavorable weather. Although this was first taken out of the regular grant, the Legislature of 1912 voted $10,000 specifically for this purpose and hence societies suffering from rain have been reimbursed on the basis of the previous three years' receipts without the grants to other societies being affected.

MANY PLOUGHING ASSOCIATIONS.

The Ontario Plowmen's Association which started a little over a year ago and which receives a grant of $500 has made repid progress. The membership has increased from 80 to 1,200 and eleven branches held plowing matches last

Keen interest is being taken in the old-fashioned plowing match.

year, giving substantial prizes. In addition to their work along educational lines these matches have proven a great source of social intercourse and have been highly appreciated for both reasons. Special attention has also been paid to competitions among junior members.

VEGETABLE AND HORTICULTURE MATTERS.

The Vegetable Growers' Association continues to increase in numbers and usefulness. At present they are testing the possibilities of New Ontario as a source of future seed supply. Last year potatoes grown in New Ontario were distributed among members in Old Ontario and the consensus of opinion was that they were equal to any imported seed. A quantity of the Gradus variety of garden peas was imported from Germany and distributed in New Ontario for testing

purposes. Unfortunately, the rainfall was heavy and the weather generally unfavorable, but in spite of this the tests were fairly satisfactory and will be continued. In addition to this, the Association held a field crop competition in celery, tomatoes, and onions. The Province was divided into districts and much interest displayed.

That Horticultural Society work continues to be effective and popular is indicated by the organization of seven new societies during the year, bringing the total to 73 and the total membership to over 12,000. By means of the improvement of parks, beautifying of streets and grounds about public institutions and the distribution of plants and seeds to school children they make their influence for good felt in the towns and cities in which they exist.

LIVE STOCK BRANCH.

The number of shows assisted by the Department of Agriculture through the Live Stock Branch is steadily increasing. In addition to the Winter Fairs at Guelph and Ottawa, which come particularly under the direction of the Live Stock Branch, financial assistance was given to 18 Horse Shows and 37 Poultry Shows in 1912. Notwithstanding the many additions which have been made for the accommodation of the winter fairs from time to time, in a very short time, owing to continued growth, the capacity is taxed to its utmost. In 1911 extensive additions were made for the Fair at Guelph, and in 1912 an addition was made for the Winter Fair at Ottawa to provide increased accommodation for all classes of exhibits, but particularly for the dairy cattle and horse departments. The attendance at both fairs is still growing and the interest taken in the course of practical lectures is still continued.

STALLION ENROLMENT.

At the session of the Legislature of 1912 The Ontario Stallion Act was passed. Under the Act appointments were made to the Stallion Enrolment Board, who prepared regulations which, in accordance with the Act, were approved by the Lieutenant-Governor-in-Council. Following is a short summary of what is contained in the Act and in the regulations referred to:

(1) Each stallion standing for service in Ontario (except in the Provisional Judicial Districts and in the Provisional County of Haliburton) must be enrolled with the Stallion Enrolment Board.

(2) A Certificate of each enrolment is issued by the Board, which Certificate must form a part of each newspaper advertisement or poster advertising the stallion.

(3) At the option of the owner, the stallion may be inspected by three officers appointed under the Act, and if such inspection is made, the report of the inspection forms a part of the record of enrolment, and the Registration Certificate is issued in accordance therewith.

(4) The Board fixes the times and places at which stallions may be inspected; notice thereof is given, so that any person desiring to procure the inspection of a stallion may present him at the most convenient point.

(5) For the purposes of the administration of the Act, a pure-bred stallion is considered to be one registered in one of the Records affiliated with the Canadian National Live Stock Records, or, in case there is no such Record for the breed, in one of the Records recognized as authentic by the Record Board. A grade stallion is considered to be any other stallion.

(6) The following are considered diseases or malformations, as the case may be: Bone spavin; curb, when associated with a formation of hock, which predisposes to curb; bog spavin, when associated with a formation of hock, which predisposes to bog spavin; spring-halt, side bone; roaring or whistling, periodic ophthalmia; and navicular disease.

(7) Six forms of Certificate are issued to provide for the following conditions: —

(*a*) Pure Bred, Inspected and Approved.

(*b*) Pure Bred, Inspected, but found to be not free from malformations and diseases named.

(*c*) Pure Bred, not Inspected.

(*d*) Grade, Inspected, and found to be free from malformations and diseases named.

(*e*) Grade, Inspected, but found to be not free from malformations and diseases named.

(*f*) Grade, not Inspected.

(8) Each enrolment must be renewed annually. In case of inspected stallions, however. the report of the Inspection Committee will hold good for two years.

(9) When a stallion is sold, a transfer must be recorded with the Board.

(10) The fees to be paid to the Board before the issue of any Certificate are:

For enrolment	$2 00
For inspection	5 00
For renewal of enrolment	1 00
For transfer certificate	1 00

(11) The penalty for contravention of any of the provisions of the Act is not more than $100, nor less than $25.

For the purpose of inspection the Province was divided into eight Districts and a route for the inspectors was arranged, naming the time and date at which they would be at each point named. The inspection points were so arranged that no stallion, the location of which was ascertained, would be required to be brought a distance greater than five miles in order to be inspected. A notice of each point of inspection was sent to each local paper in the Province and a general notice was placed in agricultural papers having a general circulation. A list was also mailed to each stallion owner whose name could be procured. The inspectors commenced work on the 29th of October.

PROFITS IN SHEEP RAISING.

The report of the second year's work at the Demonstration Stations for sheep, arranged in conjunction with the Ontario Sheep Breeders' Association, is presented below. As stated previously, the lambs raised at all stations, except Brown's Corners and Windermere, were sold when about one year old. The station at Brown's Corners was for the purpose of demonstrating the profit in early lambs, while that at Windermere was for the purpose of supplying the summer hotels during the tourist season. The report of 1911 gave the number of ewes at each station,

Demonstrations prove good profits are to be made out of sheep breeding.

the value, and the allowance made for interest on investment. In 1913 it will be noticed that the interest on investments was slightly increased in the case of three stations, on account of ewes having been lost and replaced by others. Those stations are Fairfield East, Woodville and Redgrave. A Bulletin is being issued giving a more complete and detailed report of this work.

SUMMARY OF RECEIPTS AND EXPENSES FOR TWO YEARS

First Year

Station	Receipts					Expenses				Profit
	Wool			Lambs	Total	Feed. Ewes and Ram	Feed. Lambs	* Losses	Interest on investment	Total	
	lbs.	Price	Value								
		c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.	$ c.
Perth	69	†.24	16 56	93 75	110 31	23 75	30 40	.....	5 40	59 55	50 76
Fairfield East	85	.13½	11 47	131 49	142 96	43 42	36 62	38 00	5 40	123 39	19 57
Woodville	130	.13½	17 55	162 86	180 41	43 70	39 11	8 00	7 26	98 07	82 34
Duntroon	109	.13	14 17	95 55	109 72	36 87	29 10	8 00	6 30	80 27	29 45
Paris	77	.14	10 78	158 50	169 28	52 34	60 00	.....	6 30	118 64	50 64
Redgrave	65	†.21	13 65	83 36	a101 81	43 03	37 80	6 50	5 01	92 34	9 47
Hyde Park	132	.13	17 16	128 70	145 86	53 98	58 58	.....	7 26	119 82	26 04
Windermere	100½	.13	13 06	78 00	91 06	38 88	.....	.....	6 18	45 06	46 00
Brown's Corners	80	.15	12 00	109 07	121 07	39 65	12 09	.....	7 26	59 00	62 07

*At Fairfield East Station losses included ram and two ewes. In each of the other cases one ewe was lost.
(†) Washed.
(a) Includes $4.80 for service of ram.

Second Year

Perth	71	.23	16 33	87 70	104 03	26 55	26 00	a13 00	5 40	70 95	33 08
Fairfield East	97	.14	13 58	83 33	96 91	37 33	35 62	.....	7 68	80 63	16 28
Woodville	135	.13½	18 22	120 40	138 62	42 56	39 72	.....	7 74	90 02	48 60
Duntroon	90	.14	12 60	73 20	85 80	34 93	16 35	.....	6 30	57 58	28 22
Paris	73	.15	10 95	97 00	107 95	43 81	.....	b10 00	6 30	60 11	47 84
Redgrave	62	5.12	12 00	102 75	114 75	38 40	32 97	c 6 50	5 79	83 66	31 09
		57.20									
Hyde Park	138	.13	17 94	144 27	162 21	40 42	56 74	.....	7 26	104 42	57 79
Windermere	98	.12½	12 25	60 00	72 25	33 25	.....	.....	6 18	39 43	32 82
Brown's Corners	103	80.15	14 99	168 00	182 99	57 17	.....	.....	7 26	64 43	118 56
		23.13									

(a) Two ewes worried by dogs.
(b) One ewe died and one ewe was killed by lightning, on which $6.00 insurance was received, leaving a loss of $2.00.
(c) One ewe died.

SHEEP SALES.

The Dominion Sheep Breeders' Association, of which the Director of the Live Stock Branch is Secretary, in conjunction with the Dominion Department of Agriculture, arranged for a number of sales of sheep in British Columbia and in the Maritime Provinces. The Dominion Department of Agriculture supplied the necessary funds and suggested the general plan for conducting the work. The Dominion Sheep Breeders' Association was represented by a special committee appointed for that purpose. Twenty-two carloads of sheep were shipped to British Columbia and ten cars to the Maritime Provinces. The shipment consisted of 1,153 ewes and 441 rams. The ewes were grades, while all rams were purebred and registered. Considerable assistance was rendered by this branch in the matter.

CO-OPERATIVE SHIPMENTS OF PURE-BRED STOCK TO WESTERN CANADA.

In 1912 a new plan was adopted with reference to the shipment of purebred stock to Western Canada on the co-operative plan. Previously it had been the custom to ship these cars only at such times as sufficient stock was offered to complete a full car. The difficulty with the method was that shippers and buyers could not be informed of the date of shipment, as the date could not be arranged until sufficient stock had been sold to make up a carload. This was naturally unsatisfactory to all concerned and arrangements were made to ship these cars regularly the first of each month during the months from January to July and a special car the first of October. If a breeder now has an enquiry for stock from the West, he can state definitely to the prospective purchaser when delivery can be made. Very often more than one car is required to take all the stock offered at the time of shipment. During 1912, eight cars were shipped to the West. They contained 61 horses, 49 cattle, 24 sheep and 20 swine.

Flock of sheep on Manitoulin Island.

POULTRY ASSOCIATIONS.

Provision has been made by an Order-in-Council for the organization of one recognized Poultry Association.

(*a*) In each Electoral District in the Province, except that not more than one Association may be recognized in any incorporated city,

(*b*) In any incorporated city, whether or not it is an Electoral District.

A recognized Poultry Association is one that is entitled to receive a government grant of fifty dollars and to have a lecturer supplied by the Department at a meeting which is held in most cases at the time of the Annual Poultry Show of the Association. Each Association is required to hold a show each year. The total number of entries at the shows held in 1912 was 24,221, and the amount of prize money paid to exhibitors was about $10,000. The meetings were well attended and the work being done by these associations is adding greatly to the interest taken in the improvement of poultry conditions.

INSTITUTES' BRANCH.

The activities under the direction of this Branch have become quite diversified; and while the membership and attendance in the regular institute work has shown a slight decrease, a larger number of people than ever before are being served by the regular institutes, special meetings covering fruit growing, poultry raising, dairying, etc., short courses in live stock and seed judging, Better Farming Specials, Women's Institutes, etc. A summary of the attendance during the twelve months ending with June, 1912, is given herewith:

Regular and Supplementary Meetings:	
Farmers' Institutes	86,460
Women's Institutes	177,342

"Better Farming Special" attracted much attention along lines of C. P. R.

Special Institutes:	
Farmers' and Women's Institute Conventions	6,750
Better Farming Special	18,500
Fruit Institutes	5,350
Seed and Live Stock Judging Classes	49,400
Factory and Creamery Meetings	13,761
Total	357,563

In the spring of 1911 an Agricultural Instruction Train, a "Better Farming Special," was run over the Michigan Central Railroad in Southern Ontario, and the farmers in the locality served thoroughly appreciated the variety and force-

fulness of the instruction given by the lectures, exhibits and demonstrations, covering a variety of farming operations. This was followed in the spring of 1912 by a similar work over the main line of the Canadian Pacific from Windsor to Montreal and the branch lines leading to Goderich, Owen Sound and Carleton Place. Altogether, 52 points were visited. The Canadian Pacific Railway furnished, free of cost to the Department, a train consisting of three baggage cars, three lecture coaches, a diner and a sleeper. The lectures covered beef raising, breeding of horses, improvement of dairy cattle, the feeding of live stock, seed selection, weeds, drainage, cultivation, poultry, diseases of domestic animals, bee-keeping, fruit growing, fertilizers, concrete construction, etc., and received attention in accordance with the needs and possibilities of the district visited. The lecturing force was drawn from the regular institute workers and the staff of the Agricultural College.

Short Course held under a tent.

FARMERS' CLUBS.

This is one of the most effective organizations in the Province, whereby the farmers derive direct benefit largely through their own initiative. The number of clubs is gradually increasing and the practicability of their efforts is becoming more marked. The total number of clubs is now over two hundred. The Institute Branch through its lecturers, but more largely through the District Representatives, is encouraging the extension of this feature of agricultural betterment. The clubs and the Women's Institutes are doing much through co-operation to establish a better social life in our rural communities. The young men and young women, the boys and girls, as well as the fathers and mothers, have a part in this effort towards rural betterment. Through the clubs co-operation in the buying of staple supplies, production and marketing are being encouraged and directed. In addition to the educational work which they are doing, they are a medium through which better seed and purebred stock are being introduced, the improvement of roads encouraged—in fact, all lines of work which can be the better done by united action through a local organization are encouraged by the club.

SHORT COURSES IN STOCK AND SEED JUDGING.

Classes extending over two or three days at the one point for the instruction of farmers and their sons in the judging of live stock and seeds, is one of the most effective means of stimulating the farmers to better efforts in the production of pure seed and the introduction of uniform methods in the breeding of live stock.

Through the Short Course an effort is made to instil into the minds of the boys and young men of the Province definite ideas in stock improvement and seed selection. The favorable results of this educational work are already apparent in the increased demand for purebred sires, and good quality of pure seed of the best varieties. Some fifty-six of these Short Courses were held during the year. The stock was secured from the best breeders in the district, and where a suitable building could not be secured, a tent was furnished by the Institutes Branch. The best available men were sent to those Short Courses, and by lectures, demonstrations and discussion, much valuable information is being imparted. The increased demand for these courses throughout the Province, especially in those counties where district representatives are located, indicates appreciation on the part of the farmers. During the current winter season a larger number are being held than ever before.

WOMEN'S INSTITUTES.

This branch of the work has extended into new districts and become more effective in the old organizations during the past year. The 725 branches and more than 22,000 members are not only dealing efficiently with home problems and developing a healthful sociability among the rural residents, but are making their power felt in the community life. Home problems, selection of food, cooking, preserving, labor-saving devices, sanitary conditions, etc., receive due attention; and outside of the home the Institutes are using their influence and giving support in establishing libraries, encouraging civic improvement, beautifying of home surroundings, putting down walks—in fact, in all lines of work which make towards community improvement.

DEMONSTRATION LECTURE COURSES.

The Demonstration Lecture Course in cooking given in the fall of 1911 was this year extended to include home nursing and sewing. Four workers have been engaged to give systematic instruction to groups of five or six Institutes in different localities. The lecturer spends one day a week at each Institute for a period of from ten to fifteen weeks, and those taking advantage of the courses are required to pay $1.00 each and to furnish the necessary supplies and hall. The Department bears the balance of the expense. At some points as many as eighty persons took advantage of the course and the minimum number required to form a class is twenty-five. This appears to be a most effective means whereby the women in the country districts may be given systematic instruction along domestic science and domestic art lines.

DAIRY WORK.

The past season has been most favorable for milk production both as to quantity and quality, and the high level of prices throughout the year has resulted in strengthening what is already one of the leading branches in Ontario Agriculture. The staff of thirty-four instructors report an improvement in factory

and conditions and better care of the raw material by the patrons of cheese factories and creameries. By systematic instruction in the factories and creameries and the granting of certificates to makers, much has been done to improve the sanitary conditions and equipment and also to strengthen the position of the makers. Both patrons and owners of creameries show greater readiness than formerly to comply with the suggestions of the instructors as to improvements necessary for the production of high class goods. Considerably over one hundred thousand dollars was spent in the improvement of the factories of the Province during the year.

Our Chief Instructor's report that the quality of the cheese was, on the whole, perhaps superior to other years. In Eastern Ontario some 12,000 more cheese have been made than in 1911. Figures for Western Ontario are not yet available. the total value of the dairy products of the Province, including cheese, butter, con-

Many Ontario farmers now drive automobiles.

densed milk, milk powder and the raw material shipped to our towns and cities, is gradually increasing from year to year. The Province has practically ceased to be an exporter of creamery butter, except that sent to other Provinces of the Dominion. The number of pounds of milk necessary to make a pound of cheese is less than a year ago.

Poor water is no doubt the cause of inferior quality of some cheese. Some thirteen factories in Eastern Ontario were required to provide a new water supply. When this was done, the difficulty of manufacturing a good quality of cheese was overcome.

The instructors are utilized to attend a large number of factory meetings, usually held at the time of the annual factory meeting. Some 312 factory and district meetings were held during the year. The instructors were provided with a demonstration outfit for cooling milk and cream, and the district representatives in the dairy sections of the Province were also provided with a similar outfit. No doubt this practical demonstration is one of the chief causes in the improvement

in quality of the raw material supplied. During the past season over 100 of our factories paid for milk upon the basis of butterfat content, while nearly two hundred of them were pasteurizing the whey.

With a view to gathering up-to-date and useful information on dairy matters, a survey has been undertaken in two townships in Eastern Ontario and two in Western. The townships selected are regarded as typical of general conditions, and the information obtained is expected to show modern tendencies in dairy work as well as indicate present needs.

FRUIT BRANCH.

Consequent on the interest taken in all things pertaining to fruit growing, there was an increased demand for demonstration work in the orchard. This was carried on the same as in previous years. Orchards were selected that were in a neglected condition, if pruned at all, pruned wrong, and few, if any, had ever been sprayed. Through this demonstration work in Simcoe County there is much more enthusiasm in the apple industry. In the Township of Nottawasaga many orchards are now pruned and sprayed that had no care devoted to them previous to this demonstration work. The Apple Growers' Associations in all districts welcome the demonstration workers, as they find it most difficult to put up a good pack with such poor fruit as is generally grown.

This monument was unveiled during the past year in Dundas County, to mark the spot where the first McIntosh Red apple was developed over a hundred years ago.

The Fruit Branch superintended operations in the following orchards:— 3 in Huron County, 3 in Grey, 2 in Dufferin, 5 in South Simcoe, 2 in North Simcoe and 2 in York. With the assistance of this Branch other demonstration orchards were managed by the several representatives as follows:—Waterloo 2, Elgin 1, Middlesex 1, Northumberland and Durham 4, Hastings, 6. In the Counties of Dundas and Glengarry several orchards were sprayed by the representatives.

In all districts there is a general awakening to the fact that an apple orchard is a valuable part of the farm if properly cared for. There is still much ignorance shown as to the proper pruning of a bearing tree and years of work will be required before there are sufficient trained pruners in the Province to properly handle the present orchards. As so much of the quality depends upon pruning, every man available will be pressed into service to meet the urgent requests for assistance. ,

SUCCESS IN MARKETING.

Perhaps never before has so much attention been directed to the question of marketing fruit. The abundant crop of the past year was no doubt largely responsible for this. Reports indicate a great disparity in prices obtained, but the most hopeful feature of the situation was the fact that where the apples were handled through co-operative associations fairly good prices were obtained. Outside of associations, except in rare instances, the producer got but small return for his investment and labor, while in some sections large quantities of apples went to waste. The natural result has been a renewed interest in the formation of co-operative associations. There are now fifty of these organizations actively at work in the Province and the indications are that many more will be started before another season.

Continued efforts have been made to bring Ontario fruit as well as Ontario fruit-growing opportunities to the attention of the British public. Supplementing apples and pears, shipments of peaches were made again last season and attracted much attention. Additional attention was devoted to the western market which must long be the best market for Ontario fruit. In this market Ontario has strong competition from both British Columbia and the Western States and last year it was considered desirable to place a Market Commissioner in the West during the selling season to report to the Department and the fruit growers of this Province on the conditions during the shipping season. This market commissioner reported from day to day on sales, freight rates and services, packing and packages, condition of fruit on arrival and any other points which were likely to be of assistance to the growers and shippers. Many lessons to be learned from our competitors, especially in the packing, were noted and reported on in full.

To further this work in the West, the exhibit at the Winnipeg Industrial Exhibition was again made a feature. Splendid displays of apples from the 1911 crop were shown alongside of berries, cherries and tomatoes grown in 1912. All fruits arrived in better condition than in previous years and the exhibit was a great credit to the Province. The only disappointing feature was that of the packages in which Ontario tender fruits were shipped. These are the regular commercial packages of the eastern growers, but in many respects are not suitable for the western market. This applies specially to the handled 24-quart crate which so often arrives at its destination in a damaged condition and therefore does not advertise favorably the Province from which it is shipped. Compared to the neat box packages from the western districts, Ontario baskets and crates are very frequently criticised to the detriment of those who use them.

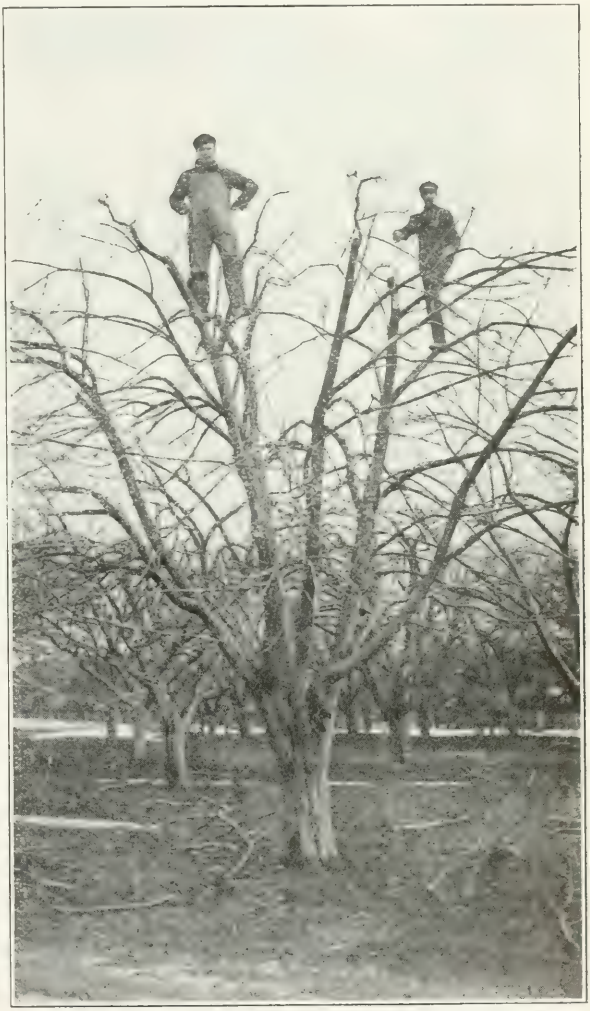
PACKING OF OUR APPLES.

The demand for fruits in the box packages has been steadily increasing, faster indeed than the growers were prepared to meet. Many sections in the west refused to accept the barrel in 1912, the wholesalers stating that the demand was entirely for the smaller and handier package. To meet this requirement of the trade, many packing classes were held during the year in those sections where it was considered the growers were ready to adopt this change. The Agricultural College added a two-weeks course in box packing and it has been well attended. To supplement this and to reach those who are unable to leave home, even for a week, three-day courses were given to which were sent four competent box packers who imparted to the growers and packers first lessons in this method of putting up choice apples.

The barrel will continue for some time to be our chief commercial package and instruction was also included in most places on the proper handling of the fruit in this package. The attention of the grower everywhere was drawn to the necessity of putting only the choicest fruit in the box, and also the eliminating of much of the lower grade fruit which is now going into the barrel.

ORCHARD COMPETITION.

Believing that the interest shown in the older and bearing orchards was beginning to bear fruit, the Department organized a competition among the growers in the various fruit districts of the Province. Cash prizes were offered to the owners of the finest orchards, the judging being done on a scale of points which covered every phase of management, from the pruning through to the marketing of the fruit. Ninety-nine entries were received and the competition was quite keen in all districts, except those in the extreme eastern and the central part of the Province where orcharding is not developed to any extent. One of the best features of the competition was the instruction imparted by the judges in their visits to the orchards. Both those who won and those who lost were given the reasons for scoring, and applications have been made for the presence of our instructors to assist in improving conditions that were pointed out by the judges.



Cutting out the useless timber in the orchard.

Perhaps the one greatest fault in the orchards was the lack of pruning. Many otherwise good orchards were ruled out entirely on account of the thickness of the tree growth, a habit which results in poorly colored and immature fruit at harvest time. Many of the orchards that received prizes were visited by the growers in the surrounding sections, who made a careful study of the methods adopted and much good should be effected by such influence.

FRUIT EXPERIMENTAL FARM.

The Fruit Experimental Farm at Jordan Harbor is making good progress considering that it is in the initial stages of its development. As is well known the work in developing an orchard and especially the work in plant breeding requires considerable time. The orchard has been planted out as follows:—Peaches, 11 acres; pears, 5; plums, 3; apples, 15; cherries, 3; grapes, 2½. A small crop of peaches was harvested last year but the yield should now steadily increase and the other fruits should also be in bearing in a few years.

The following list of experiments which are being carried on is of interest:

Apples:

Under this fruit, the following were decided on:

(1) Use of Poucin stock to semi-dwarf trees for more ready treatment for San Jose Scale (2 of each).
(2) Testing of following stocks for top-grafting King and Spy, McMahon Tolman, Hibernal, Baxter, Haas, Ben Davis, Pewaukee and Duchess (4 of each).
(3) Low-headed *vs.* high-headed trees (4 of each type).
(4) Use of fillers, including Milwaukee, Wealthy and Duchess.
(5) Testing of Central Experimental Farm hybrids considered promising.
(6) Testing of new varieties to be chosen by Secretary and Superintendent.
(7) Culture tests.

Cherries:

(1) Culture tests (Wood, Napoleon, Tartarian, Windsor, Dyehouse, Richmond, Montmorency, Morello).
(2) Tests of varieties.

Grapes:

(1) Six training methods (6 varieties, 10 of each)—Niagara, Concord, Lindley, Worden, Campbell, Vergennes.
(2) Variety of tests (3 of each).
(3) Central Experimental Farm varieties for test.

Peaches:

(1) On plum stocks. (A. M. Smith is growing stock for 1909.)
(2) Cover crops using standard varieties.
(3) Variety tests (3 of each).
(4) Culture tests, including methods of pruning (12 of each)—Dewey, St. John, Rose, Brigdon, Engol, Elberta, Smock, New Prolific.
(5) Fall *vs.* spring planting of Elberta (6 of each for 4 or 5 years).

Pears:

(1) Blight experiments.
(2) Dwarfs *vs.* standards for commercial orchards.
(3) Variety tests.
(4) Culture tests.
(5) Fall *vs.* spring planting of Clapp (6 trees for 4 or 5 years).

Plums:

(1) Rot control on Yellow Egg, Lombard, Hand, Washington, Pond, Duane, Gueii.
(2) Culture tests.
(3) Variety tests.
(4) Fall *vs.* spring planting of Reine Claude (6 trees, 4 or 5 years).

Quinces and Apricots:

(1) Variety tests.

Small Fruits:

Strawberry—
(1) Cultural and variety tests.
Gooseberry and Currant—
(1) Cultural and variety tests.
(2) Pruning systems.
(3) Control of aphis and mildew (R. Herbert, Cuthbert).

Raspberry and Blackberry—
(1) Pruning systems (B. Cumberland, Gregg, P. Columbian).
(2) Variety tests.

General:
(1) Fumigation and dipping of nursery stock.
(2) Growing of seedlings in quantity of all fruits.
(3) Origination of new varieties by artificial and natural cross breeding.
(4) Effect of crown gall and hairy root on nursery stock.

Vegetable experiments to include—
(1) Tests of following: Beans, tomatoes, corn, peas, asparagus and beets for canning factory and market purposes.
(2) Canadian-grown seed.

View of one corner of the Ontario Fruit Show.

SUCCESSFUL FRUIT SHOW.

One of the most striking illustrations as to the awakening that has taken taken place in fruit growing in this Province was furnished by the remarkable exhibit of apples at the Winter Fruit Show. Held in one of the largest buildings on the Exhibition Grounds, the show more than crowded the large space available and more accommodation on the grounds has already been granted for 1913.

The prize list was largely increased to permit of competition for greater quantities of boxed apples. The growers evidently appreciated this opportunity of showing their skill in using the box package, over 3,000 boxes, all well packed, being on display. The difference in these exhibits comparing the shows of 1905 and 1912 was startling and showed that the educational work of the Department in this one branch alone had greatly improved the methods of our growers within a comparatively few years.

The season of 1912 was notable for the amount of scab present on the fruit, yet the entire exhibit in all sections was absolutely free from disease. Spraying is now recognized as a regular practice in good orchard work.

DISTRICT REPRESENTATIVES

The progress made in connection with the work of the district representatives has been no exception to former years. It is gratifying to note the interest and support given the various representatives by the farmers of the Province. The work in general has not changed to any considerable extent. However, each County presents new problems, and new men coming into the field have a tendency to introduce new ideas. During the past year eleven offices were opened in the following Counties:—

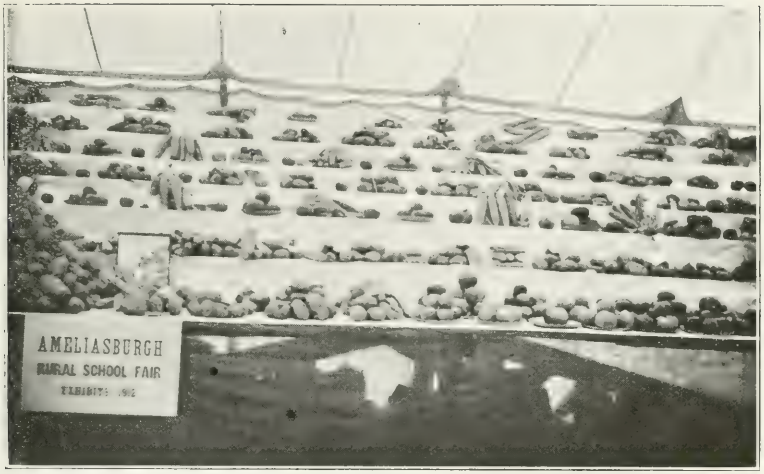
Brant.	Paris.
Bruce.	Walkerton.
Frontenac.	Sydenham.
Glengarry.	Alexandria.
Kent.	Chatham.
Leeds and Grenville.	Athens.
Lennox and Addington.	Napanee.
Manitoulin.	Gore Bay.
Middlesex.	London.
Timiskaming.	New Liskeard.
Welland.	Welland.

In response to requests from New Ontario for assistance, temporary offices were opened during the summer months at Burk's Falls, Sudbury and Dryden. This brings the total number of offices up to thirty-one. Nearly all are supplied with an assistant and a stenographer, and in some cases it has been found necessary to supply offices with two assistants during the busy season.

RURAL SCHOOL FALL FAIRS.

It is generally admitted that the first principles of agriculture should be made clear to the minds of the boys and girls in the rural districts. The value of pure seed, large plump seed as compared with small, shrunken seed, high ger-

Boys and girls at one of the twenty-five Rural School Fairs held during the past year in Ontario.



Crops from children's plots.

This young farmer grew Oats in competition as tall as himself.

minating power, proper cultivation of the soil, soil fertility and many other subjects of equal importance should be clearly understood. Two years ago a Rural School Fall Fair was conducted in Waterloo County. Those competing in the fair comprised a number of schools converging to a common centre. The district representative made out prize lists, including grains, roots, potatoes, weeds, collections of insects, cooking and sewing and essays, then visited the schools in the spring and explained the principles of the scheme. After the entries were made, the various materials were supplied to the young competitors—seeds of varieties best suited to the district, eggs from hens of special breeding, and instructions covering each class, all free of charge. During the summer the children's plots were carefully inspected and scored, and at the end of the season prizes given to those receiving the highest score. Later in the autumn the fair was held at the most central school and all the exhibits shown and judged by a

One of the many classes in Agriculture conducted by District Representatives.

competent judge, and suitable prizes given. As a result of the success of this undertaking the Department decided to extend this work, and last fall 25 Rural School Fall Fairs were held in 12 different Counties, each one most successful in every way. As a rule from 8 to 12 schools were represented at each fair, and as many as 500 entries have been entered at a fair. In some cases a large tent was erected and suitably fitted for the exhibits. It is pleasing to note the interest taken by the parents of the young competitors—the attendance at these fairs often numbering 600 to 700. When it is understood that the boys and girls are made responsible in a large degree for the success of the fair, the work being directed by the teachers and the district representative, one easily realizes the importance of such a work. It is felt that this work can be materially extended with advantage, especially in view of the encouraging reports received from the districts in which fairs were held this year.

COURSES IN AGRICULTURE.

In furtherance of the idea of interesting the children of the schools in elementary agriculture, the district representative has found a large field for work among the young men on the farms ranging in ages from fifteen to thirty. In many cases there are young men who are anxious to avail themselves of agricultural instruction, but either cannot afford to take a course at the Agricultural College or are unable to spare the time necessary for such a course. In order to cater to this class, a four to eight weeks course in practical agriculture has been instituted, conducted usually in connection with the high school during the slackest season of farming operations.

First County Board of Agriculture in Ontario organized in Waterloo County.

This course is made as broad as possible, but special attention is given to the classes of crops and live stock that are of particular interest to the district in which the course is being held. The forenoons are devoted to the study of soils, fertilizers, field crops, types and breeds of live stock, principles of breeding, bookkeeping and business methods; the afternoons are usually spent in practical work, such as pruning and grafting, apple packing, milk testing, seed testing, seed judging, and one or two afternoons each week the class goes to a stock breeder's farm where they are given lessons in the judging of live stock. During the past year 19 of these courses were held in different counties in the Province, 377 young men availing themselves of this opportunity for receiving instruction.

FARMERS' CLUBS.

The Farmers' Club movement is receiving a stimulus as a result of the work of the district representatives. Upwards of 225 clubs are in existence and with

few exceptions are in a healthy condition. In Grey County the clubs succeeded in securing a Continuation School at Chatsworth with an attendance of 40 pupils. As a result of addresses at these clubs, a produce store was opened and the farmers are being paid for their butter and eggs according to quality. Other clubs held Stock Judging Courses, secured rural mail delivery, municipal telephones. In Northumberland County three clubs, ten to fourteen miles from the railway, have been purchasing staple articles, such as seed corn on the cob, flour and feed, coal oil, wire fencing, salt, binder twine, lime and spraying material. One club handled over $3,000 of goods and saved for its members $500 from March to June, 1912. A Cow Testing Association was the outcome of another club in the same County. Many other instances of a similar nature may be cited to show the commercial importance of Farmers' Clubs but there are other features which must not be lost sight of. The frequent meetings are resulting in a closer neighborhood of

Short Course in Live Stock on a Manitoulin Island farm.

acquaintance, a broader social outlook, a deeper interest in the farm, more ideas put into operation and a better community life in all its phases.

The County Board of Agriculture is the natural growth of the Farmers' Club movement. It is in reality a federating of the Farmers' Clubs in each County, and fulfils the same purpose for the farmer as the Boards of Trade do for the city or town. The County of Waterloo was the first to adopt this organization, and during the past year the Counties of Grey and Prince Edward have organized along similar lines.

DEMONSTRATIONS.

The district representative has been able to do a great deal through meeting the farmer upon his own farm and assisting him to solve many problems, such as the use of fertilizer, drainage, pruning, spraying, feeding of live stock and many other things of a similar nature. But it has been found that demonstrations conducted co-operatively between the farmer and the representative have been even

more effective in getting the farmer to adopt new methods of farm practice. It has been suggested that each representative should be supplied with a farm for the purpose of demonstrating what can be accomplished through the use of good seed, proper soil cultivation and efficient business management. While the farm may be used successfully to carry out this idea, it is objectionable from the fact that the effect, if any, would be very local and the representative would not be able with all the other lines of work under his direction to give the farm the close supervision necessary. Instead of this the representative secures the co-operation of a large number of farmers in his County, each one to undertake the growing of one particular crop under his direction. In this way the crops that would have been grown on a demonstration farm are spread over a very much larger area, and the importance of good seed, proper cultivation, etc., is brought home to the farmer in a very striking manner. Such crops as alfalfa, potatoes, corn, mangolds, oats, barley and apples have been used effectively in demonstrating the value of improved varieties and methods of culture. Some of the results of this work are given in detail below.

Spraying potatoes produced good results.

TREATING POTATOES FOR BLIGHT.

The wet season of this year has assisted materially in demonstrating the advantages of spraying potatoes with Bordeaux for the control of blight. As a result of this disease thousands of bushels of potatoes rotted in the fields that might have been saved at a very small cost. A very striking illustration of the value of Bordeaux is shown from the results of a demonstration carried on by a farmer and the District Representative in Leeds and Grenville. The following is a detailed statement of the demonstration and results:—

Mr. Livingston had a plot of half an acre in potatoes, different sections of the patch were staked out, part being sprayed with Bordeaux and part with Paris Green in the usual manner. The poison Bordeaux was made up of 1 lb. Paris Green, 4 lbs. copper sulphate (Blue Stone), 4 lbs. of lime freshly burned, and 40

gallons of water. The potatoes sprayed with Bordeaux yielded at the rate of 279 bushels per acre. Those sprayed with Paris Green yielded at the rate of 252½ bushels per acre, but in the latter case there were rotten potatoes to the extent of 10 bushels per acre, whereas there were no rotten potatoes in the plots sprayed with Bordeaux. Deducting 10 bushels of rotten potatoes, the yeld of potatoes from the plots sprayed with Paris Green was at the rate of 242½ bushels per acre. Increase per acre from spraying with Bordeaux is 36½ bushels. These potatoes were sprayed on the following dates, July 19th, July 30th, August 14th and September 7th. Averaging the quantity of material used on these potatoes for the four sprayings, it required 3 barrels of the mixture to cover an acre at one spraying, therefore the amount of Bordeaux equired on one acre for the season was 12 barrels, costing as follows:—

48 lbs. copper sulphate at 11c.	$5 28
48 lbs. lime at 4 lbs. for 10c.	1 20

The increased cost of using Bordeaux rather than Paris Green was $6.48 per acre. No account for labor or for Paris Green is charged against the Bordeaux-sprayed potatoes, because it takes practically the same time to spray an acre with Paris Green solution as it does with Bordeaux, and the same amount of Paris Green is required in both cases. As a matter of fact, the potatoes in this experiment which were not sprayed with Bordeaux required one more application of Paris Green than did the Bordeaux-sprayed plots.

Potatoes last fall sold at from 40c. to 50c. per bushel, taking 45c. as the average price, the increase of income from the use of Bordeaux is 36½ bushels of potatoes at 45c., $16.43, from which must be deducted $6.48 for increased cost of spray material, leaving $9.95 profit.

Mr. Livingston states that his potatoes are keeping exceptionally well, while potatoes that were not sprayed are rotting badly. One man who put 800 bushels in his cellar in the fall in sorting them some time ago removed some 200 bushels of rotten potatoes.

In the United Counties of Northumberland and Durham the results are even more striking. These sprays were applied every two weeks from the 1st of July when the plants were just nicely above ground until about the middle of September. The result of the spraying is appended herewith:

	Decayed when dug.	Sound when dug.
Arsenate of Lead and Bordeaux	.....	473.3 bus. acre
Arsenate of Lead	3.3 bus.	415 " "
Paris Green and Bordeaux		372.1 " "
Arsenate of Lead and Lime Sulphur...	.....	366.6 " "
Paris Green	2.5 bus.	323.3 " "
Bug Death	3.3 "	301.6 " "
Unsprayed	2.1 "	188.3 " "

It will be seen that Bordeaux and Arsenate of Lead gave the best results, yielding over 473 bus. per acre: Arsenate of Lead better than Paris Green, though not poisoning as quickly. Paris Green alone gave only 320 bus., which show every indication of decay.

MUSTARD SPRAYING.

In a number of Counties where the weed has become troublesome the representative has found an opportunity for demonstrating the effective use of 20 per cent. solution Iron Sulphate in the eradication of this noxious weed. In the

demonstrations carried on this year the mustard was sprayed in the early stage of the blossoming period, the flowers were completely destroyed without any effect whatever upon the grain crop. As a result of this work farmers in many parts of the Province are making enquiries of the Department for information along this line.

DEMONSTRATION APPLE ORCHARDS.

In a number of Counties where apples are grown extensively the representative, in conjunction with the Fruit Branch, has assisted materially in arousing an interest in the better treatment of orchards. During the past year 143 one-day orchard meetings were held where the farmers had an opportunity of learning at first hand, under the direction of an experienced orchardist, the proper methods of pruning, spraying, thinning, care and cultivation. 7,150 farmers availed themselves of this opportunity to benefit by these meetings. Later in the season a number of apple packing demonstrations were given in order that the farmer might

The Apiary in the orchard.

learn the different methods of packing fruit and be in a better position to cater to the best markets. To make these meetings more effective and disillusion the less sanguine ones, 28 orchards were managed co-operatively. The most up-to-date methods were practised and an accurate account kept of the expenditures. With very few exceptions these orchards had the effect of encouraging a large number of farmers to clean up old orchards and put them in a proper state of cultivation. These same orchards in many instances had been neglected for years and yielding practically no revenue. As an example of what may be accomplished in this connection, I give herewith a report of two demonstration orchards in Waterloo County where apples are not generally considered one of the main crops. One of these, known as the Currie orchard, is a typical farmer's orchard of 100 trees, mixed varieties, old and young trees. The other, known as the Caldwell orchard, is a commercial orchard of 500 Duchess trees. The Duchess orchard gave an

excellent demonstration this year. Situated next to it, on the same property, is another Duchess orchard of 300 trees. When we took over the orchard two years ago, conditions in the two were the same, trees same distance apart, same age, and same lack of care all through. Last year there was no crop on either orchard, but this year the cared for orchard carried 700 barrels of fruit, and from these 700 barrels there were but 51 bags of culls. Even this small amount of culls was not due to worms or scabs, but to small or green fruit or branch marks. On the uncared for orchard there was no marketable fruit. Two years ago parts of the Duchess orchard were badly infested with oyster shell bark louse; the second year of lime sulphur application completely eliminated this pest. The following is a summary of our accounts with these orchards for 1911 and 1912. These do not include accounts for permanent outfit, such as spray pump, etc.

CURRIE ORCHARD.

1911.

Expenditures.		*Receipts.*	
Rent	$25 00	106 barrels apples	$319 75
Labor and teams, pruning, scraping, spraying, cultivating, hauling apples, etc.	147 40	Culls	24 10
Spray material	16 75		
Barrels	48 00		
Profit	106 70		
	$343 85		$343 85

1912.

Accounts not all in. About 60 barrels are in cold storage, to be sold in the spring. An estimate of profits shows that net returns will be a little in excess of 1911 profits.

CALDWELL ORCHARD.

1911.

Expenditures.		*Receipts.*	
Rent	$175 00	Apples sold	$74 43
Spray material	37 65	Loss	278 67
Labor, pruning, cultivating, spraying, etc.	140 45		
	$352 10		$353 10

1912.

Rent	$175 00	680 barrels at $1.00 on the tree..	$680 00
Other expenses	216 00	Culls (about)	10 00
Profit	299 00		
	$690 00		$690 00

EGG CIRCLES.

In my annual report for 1911 I gave a somewhat detailed account of the co-operative work as carried on in Ontario County. During the past year, under the guidance of the District Representative, this work has met with most encouraging results. There are now eight associations with a total membership of over 500 farmers—an increase of over 100 per cent. in the last year: this has been largely due to farmers asking permission to join one or other of the organizations already established. In the case of one Association, with headquarters in Cannington, the

business averaged over $1,000 per month for ten months, and the total production for eight Associations was 16,000 dozen per month. The movement has made a natural growth, its development being entirely due to the success of the organizations which were first established. The growth and popularity of the movement have been brought about largely on account of the increased prices which the members of the Associations have been receiving over prevailing market prices. The advance in the spring and summer season has ranged from one to three cents, and in the fall and winter months from as high as three to twelve cents. This premium which these organizations are receiving is directly due to the improvement in the quality of the eggs sold.

The success of Egg Circles in Ontario County is largely responsible for the development of similar organizations in the Counties of Leeds and Grenville, York, Grey, Dundas, and Northumberland and Durham. A good start has been made in each of these counties, and we expect to have concrete results of a creditable nature during the next year.

Rural School Fair boy and his chicks.

The Dundas County Co-operative Poultry Association's report of the year's business showed the shipments of eggs to have amounted to 29,048 dozen and 11 eggs, for which the sum of $8,182.28 was received. Average net price per dozen for the season was 24.16c.; average price at stores was 20.56c.; or, in other words, the members of the Association received $1,045.73 as a premium for putting a first class article upon the market.

Up to the present time these Associations have confined themselves entirely to the sale of eggs, but it is probable they will be the means of making farmers appreciate the value of co-operative marketing, and that many other lines will be introduced from year to year.

FALL FAIR EXHIBITS.

This year 52 exhibits were displayed at the Fall Fairs throughout the Province. In the majority of cases a tent was erected and the representative surrounded himself with illustration material to be used in showing the value of many and varied methods of work. The importance of this work can only be appreciated

by attending any of these fairs and noting the number of farmers who visit the booth in search of information. As an example of what is used as illustration material for this work, I append the following:

Material illustrating the benefits from under-drainage—samples of grain and sheaves from drained land and undrained fields adjoining; samples of tile illustrating the various kinds, various sizes, tile outlets, methods of joining tile, experiments illustrating the porosity of tile, cards pointing out the advantages of draining;

Charts illustrating the results of experiments, such as the date of sowing, the yield of the best varieties of different farm crops;

Samples of pure seeds, weeds, weed seed, insects, diseases of fruits, vegetables and farm crops, alfalfa from inoculated seed and from seed not inoculated;

Exhibit of model poultry houses and fixtures;

Samples of spray materials, pruning tools, collection of variety of apples grown in the County, display of apples in boxes, box apple packing equipment;

Charts illustrating seed selection and cow testing.

DRAINAGE SURVEYS.

Showing how a good potato crop was produced where a swamp formerly flourished.

Owing to the excessive wet weather of last year the importance of drainage has attracted the farmer more than ever before. The drained fields dotted over the Province were striking illustrations of the advantage of drainage. During the year the District Representative made 310 drainage surveys for farmers, in fact a number of representatives were unable to make all the surveys asked of them. The total area covered was in the neighborhood of 12,000 acres. The results of experiments show increased yields from drainage to average $20 per acre—in other words, the value of the increased yields as a result of this drainage work done by our District Representatives for 1912 will mean $240,000 each year to the farmers of the Province.

ALFALFA.

The growing of alfalfa is becoming more common throughout the Province each year. It is a clover which has stood the test both as a food for stock and also as a soil builder. The one great objection to alfalfa has been the difficulty in securing a good stand of plants. It has been found, however, that Canadian-grown seed, or, in other words, seed that has been acclimatized will withstand our winter and insure a good stand of clover for a long period of years. Demonstration fields of alfalfa where the seed has been supplied by the Department through the District Representatives, along with results of experiments at the Agricultural College, have clearly demonstrated the value of Canadian-grown seed in preference to seed from warmer climates. The following is the result of a carefully conducted experiment in

Durham County. Equal sized fields were used to test alfalfa as to hardiness, yield, etc., and at the same time to test the different methods of sowing. The result of this experiment is as follows:

Nature of Experiment.	When Harvested.	Yield per acre (dry).	
	June 21	3.25 tons	
Canadian-grown (inoc.) Bare Fallow	Aug. 1	1.26 "	
	Sept. 12	1. 4 "	
			5.9 tons
Canadian-grown (inoc.) Oats, as nurse crop	June 21	3.07 tons	
	Aug. 1	1.65 "	
	Sept. 12	1.15 "	
			5.87 tons
Canadian-grown		3.2 tons	
	Aug. 1	1.15 "	
	Sept. 12	1.35 "	
			5.70 tons
Canadian-grown (inoc.) Barley, as nurse crop	June 21	2.02 tons	
	Aug. 1	1.32 "	
	Sept. 12	.97 "	
			4.31 tons
Montana (inoc.) Barley, as nurse crop	June 21	1.65 tons	
	Aug. 1	.65 "	
	Sept. 12	.81 "	
			3.11 tons
Turkistan (inoc.) Barley, as nurse crop	June 21	1.87 tons	
	Aug. 1	.73 "	
	Sept. 12	.40 "	
			3.0 tons

It will be noticed that there is very little difference between the various fields of Canadian-grown alfalfa, but a marked difference between these and those of other varieties. The plants on the Turkistan plot are practically all dead. This field yielded only four tons per acre the last cutting on September 12, which shows conclusively that this variety is not hardy enough in this district. It will also be noticed that there was very little difference between the plots for which the seed was treated with nitro-culture and those for which it was uninoculated. This was due, no doubt, to the nature of the soil and to the fact that clover seems to grow spontaneously on it. In cases were Bare Fallow was used, the seed was not sown until about the middle of July. On the other plots it was sown in the early spring. The second cutting was attacked by what appeared to be alfalfa leaf spot, which no doubt accounts for the low yield.

GETTING IN TOUCH WITH THE PEOPLE.

One of the big reasons for the success of this work is because the District Representatives are enabled to get in personal touch with the men on the farms. The extent to which this is accomplished is shown by the following brief statement of the attendance at the various meetings and demonstrations held throughout one County in the past year, also statement of letters received and sent out, drainage surveys made, and extent of underdrainage completed:

Callers at Office	2,087
Letters sent out	460
Letters received	460

Circular Letters sent out	4,000
Drainage Surveys	20
Acres Surveyed	2,000
Miles Tile Draining Completed	22
3 Fair Exhibits	5,650
5 Farmers' Institute Meetings	250
28 Farmers' Clubs	400
2 Cheese Meetings	150
3 Box Apple Packing Demonstrations	210
5 Pruning Demonstrations	285
7 Demonstrations in Preparing Spray Materials.	86
2 Apiary Demonstrations	100
2 Short Courses	2,000
1 Rural School Fall Fair	800

With more or less similar work going on in some thirty other counties it will at once be recognized that a very large percentage of the farmers are being reached and benefited each year.

Busy scene in a canning factory district.

LIVE STOCK IMPROVEMENT ASSOCIATION.

The forming of Live Stock Improvement Associations was an important feature of the work carried on by the District Representatives in New Ontario during the past year. In settlements selected by the representatives where a membership of twelve could be secured an Association was formed, the fee for each member being $1. Each Association was given the choice of one bull, five rams, or 2 boars of any breed considered suitable to the district—the Department placing the animals at the disposal of the Association free of charge. These animals are to be inspected at intervals in order to insure their proper treatment, and when an Association fails to comply with the regulations of the Department it ceases to exist and the animals are loaned to a more deserving Association. It is hoped that assistance of this nature will result in improving the live stock and in

helping the farmer to appreciate the value of purebred sires. It is also hoped that it will be the means of establishing community breeding and that each settlement will become known by the breeds of live stock raised by the farmers. In order to insure these results the Department will endeavor to supply the same breed of male animals in each district from year to year. During the past year 29 Associations were formed in New Ontario, and male animals will be provided before the breeding season. In the Associations where bulls will be supplied the membership averages 25 and the cows in each Association 65. From reports received from the members of these Associations it is quite evident that the efforts of the Department along this line are being appreciated. So far this work is largely in the experimental stage, but present indications would warrant its further development.

DEMONSTRATION FARM.

Five years ago the Government selected 800 acres of land at Monteith to be used as a Demonstration Farm. The land is heavily wooded, rolling, well watered, and the soil is a heavy clay with from six to eight inches of humus or decayed vegetable matter. Sixty-five acres of this land are under cultivation, 45 acres in stumps and ready for breaking, and about 35 acres slashed and burned, which will be seeded to clover and used as a permanent pasture—making in all a clearing of 145 acres.

With the appointment of the district representative at New Liskeard during the past year, the farm was placed under his immediate supervision. The four main objects of conducting the Demonstration Farm are, first, to show what can be accomplished in the way of growing crops and live stock through the adoption of good farm practices; second, to test varieties of grains, roots and vegetables as to their adaptability to the northern climate; third, to grow such varieties of grain, roots and vegetables that have proved suitable in comparatively large quantities to be sold to the settlers at moderate prices; fourth, to establish a live stock breeding centre where purebred animals of the most desirable breeds will be bred and distributed throughout New Ontario with a view to building up or improving the flocks and herds. Three dual purpose Shorthorn cows were placed on the farm in August, two of them have calved since their arrival and records are being kept of the amount of milk produced. Later a purebred Shorthorn bull will be purchased for breeding purposes, and will be available to the farmers of the district for a moderate service fee.

During the fall and winter months attention was directed to clearing operations entirely. Thirty-five acres on the north side of the T. & N. O. Ry. were underbrushed and slashed and fifty cords of pulpwood were taken out and sold. Early in May the slashing was burned over, and with the exception of ten acres is now logged and ready for burning the second time. A number of the better logs were selected for lumber and a quantity of cedar was also laid aside for fencing purposes. In addition to the clearing on the north side of the track, about ten acres were underbrushed and slashed on the south side of the railway, and a number of logs selected for lumber. The output of lumber for the season consists of thirty-one thousand feet already sawn and approximately twelve thousand feet in the log.

About forty acres were devoted to crops this year, and after making due allowance for the unfavorable season and the fact that the first clearing was made on the farm only three years ago, the results have been quite satisfactory. In the fall of 1911 three acres were sown to fall wheat. Despite the unfavorable winter, it

suffered little or no damage and proved to be a banner crop; it was entirely free from rust but was slightly affected by the Wheat Stem maggot and a trace of Stinking Smut. The crop was harvested about the twelfth of August, and while it has not been threshed yet, the yield might be reasonably estimated at thirty-five bushels to the acre. It was seeded to clover early in the spring and an excellent catch was obtained.

Inspector looking for foul brood among bees.

During the third week in May about seven acres were sown with oats. Two acres were devoted to "Golden Dewdrop" and the rest to "Banner." The weather was very unfavorable for harvesting this crop, but it was finally stored in good condition. Although the yield will not reach the record of past seasons, fifty bushels to the acre would be a conservative estimate. Three acres were seeded to clover as well and the catch was all that could be desired.

Two acres of "Canadian Beauty" peas were sown on the twentieth of May but the season was so wet and cloudy that the abnormal growth of straw precluded a satisfactory yield of grain, and early in September the crop was rolled down and plowed under with a disc plow. Even in a normal season there is a rank development of straw in Timiskaming and only early, short-strawed varieties of peas should be grown while the soil is new and rich in nitrogen. There are no pea weevils in this district yet, but the crop is subject to damage from mildew and rust in wet, cloudy seasons.

On June 5th two acres were sown to alfalfa with a bushel of barley to the acre as a nurse crop. An excellent stand was obtained and the barley proved to be an average crop as well. The alfalfa seed was treated with a nitro-culture and a remarkable development of nodules on the roots was noticeable ths fall. When the barley was harvested early in September the alfalfa was fifteen inches high and quite uniform throughout. The barley was well matured when cut and should yield about twenty-five bushels to the acre.

The hay crop of the district was comparatively light this year and much

difficulty was experienced in saving it properly. The crop at the farm did not yield more than a ton and a half to the acre. The clover wintered well but the cold wet weather retarded growth in the early part of the season. About twelve acres were under clover, and while there was a good second growth, the stock were turned on it to pasture and it was not harvested.

In addition to what was grown on the experimental plots, two acres of potatoes, one acre of turnips and two acres of flax were grown, but the results were similar to those indicated by the experiments.

Only medium results were obtained from garden truck. Lettuce, dutch sets, beets, carrots, parsnips and mangolds were subject to the unfavorable weather conditions which prevailed throughout the season. Celery proved an exception, but suffered in comparison with results obtained in previous seasons.

A number of young forest trees were obtained from the Government nurseries in Norfolk County; these have been placed in nursery rows at the farm and are doing well. The varieties include white pine, Scotch pine, Norway spruce and white cedar.

The spare time during the summer was devoted to stumping, grubbing and plowing four acres of new land. In addition, sixteen acres of fallow were plowed and the roots picked off twice. An excavation was made for the basement of a farm house to be built next year, and the space under the bridge leading to the barn was filled with earth. Since October all spare time has been employed in logging the slashing north of the railway.

A small area of clover stubble was prepared and sown with winter wheat during the first week in September and the results are quite satisfactory. Sufficient growth has been made to insure ample protection for the winter.

COLONIZATION AND IMMIGRATION

The records of this Branch show the following additions to the Province during the past twelve months:

Number of farm laborers sent to farms by Bureau of Colonization.....	2,553
Number of farm laborers sent to farms by Salvation Army	913
Number of other immigrants brought to Ontario by Salvation Army ...	2,804
Number of domestics placed by Salvation Army	258
Number of domestics given twenty-four hours' accommodation at the Women's Welcome Hostel and placed by them	1,385
Number of domestics on whom the $5 bonus was paid	1,993
By other agents	1,341
Total	11,247
Less duplicates included in above	876
Net Total	10,371

This is an increase of over one thousand above the same records of the previous year, but of course constitutes only a fraction of the total number who came to the Province during the year. Ontario continues to attract a large percentage of the flow of immigration, but still the demand for farm labor and domestic servants is very great. One of the chief difficulties appears to be the fact that so many farmers employ for only six or eight months in the year. The men thus released necessarily drift to towns and cities and the next year the farmer must start over again to secure help. Repeated attention being directed to this fact, an increasing number of farmers are arranging their work so as to give employment to a married man the year round. This also gives the men a better chance, and among the most encouraging letters received by this Bureau are those from men who started this way a few years ago but who now own their own farms and seek men on their own account.

In addition to distributing large numbers from Toronto, this Branch has during the past year had an officer at the port of landing to send men direct to places in Eastern Ontario, and this plan has worked very satisfactorily.

Great interest has also been shown in the free lands of New Ontario and a great amount of information has been distributed both to visitors personally and through literature.

WORK IN GREAT BRITAIN.

Evidence accumulates to show the increasing degree of interest which the Province of Ontario is attracting in Great Britain, due largely to the work of the London Office in distributing information as to its many advantages. The energetic advertising and lecturing campaign carried on to show that all the opportunities Canada had to offer were not to be found West of the Great Lakes is producing splendid results. Note, for instance, the great increase in the correspondence:

	1911.	1912.
Inward Letters	9,091	23,578
Outward Letters	11,353	26,487

These included enquiries from every country in Europe as well as from India, Asia, Africa and Australia. Personal attention was given at the office at 163 Strand to about 16,000 callers and nearly a million and a half pieces of literature were distributed. A gratifying feature was the interest shown by men with money for investment. Altogether, 7,578 persons were sent to Ontario through the office in London and in Ireland, and the amount of capital taken is estimated to be upwards of one million dollars.

The London office, as in the previous years, handled the sum of $20,000 set aside to assist the passages of experienced farm hands or domestic servants. No more than $20 was advanced in any one case, and then only after enquiry by the staff. This offer was eagerly taken advantage of and the entire sum was used. In fact considerably more could have been used to advantage had it been available. In each case the person receiving the loan enters into an agreement for its repayment on this side and I am glad to say these agreements are lived up to in between 80 and 90 per cent. of the cases. Three conducted parties of domestic servants were brought out during the year and each was most successful.

Party starting from the Old Land for Ontario.

FACTORY INSPECTION.

In this Branch the work has been carried on along the established lines of former years.

There were 9,096 inspections and other visits made during the past year in 403 cities, towns, villages and hamlets. In addition to those inspections were investigations of accidents, which each year receive more attention. In the following table is shown the variety of places inspected and the number of inspections in each place:—

Agricultural Implements	45
Brick, Tile and Cement	77
Cotton	34
Clothing	1,435
Conveyances and Accessories	162
Chemicals	109
Food	635
Glass	66
House Furnishings	8
Metals, Founding, etc.	268
Metals, Mfgs. of	344
Laundries, Chinese and others	695
Leather and Leather Goods	181
Loco. and Car Shops	53
Lumber and other Woodworking Trades	926
Machinery	133
Paper and Paper Trades	352
Rubber and Gutta Percha	22
Mica	35
Stationary Engineers	187
Flax, Twine and Cordage	13
Tobacco	108
Woollens	246
Bakeshops	411
Confectionery	197
Boot and Shoe Stores	52
Drugs	25
Dry Goods Stores	257
Fancy Goods	75
Furniture	21
General Stores	92
Groceries	86
Hardware	19
Jewellery	27
Music, Books and Stationery	66
Millinery	220
Tailoring Establishments	316
Unclassified	761
Mineral Water	7
Other Visits	430

In these factories and mercantile establishments there were approximately 279,286 employees.

Recommendations made by the Inspectors number 4,136, dealing with the following subjects: boiler inspection, cleanliness, child labor, guarding of elevators and hoists, fire protection, guarding of machinery, hours of labor, mode of wearing the hair, sanitation, seats for females, installing of fans for the removal of dust, fumes, etc., ventilation, lighting, the providing of rooms separate from laundries (Chinese) for eating and sleeping apartments; and other miscellaneous orders. Advice has been received that many of these recommendations have been or are being complied with.

The mileage covered by the Inspectors during the twelve months was 58,206. This is exclusive of livery and street car trips.

To effectually enforce the law, it was necessary to resort to the Courts in a few cases, and 9 prosecutions took place during the year. In each case conviction was recorded, and fines imposed, as follows:

The Knechtel Furniture Co., Walkerton, for violation of the Child Labor Law. Pleaded guilty, and was fined $5.00.

Thomas Bros., St. Thomas, for violation of the Child Labor Law. Fine imposed, $10.00. The parent of the boy employed was also fined $10.00 for allowing his son to work in a factory contrary to the Act.

David Epstine, Ottawa, prosecuted under Section 16 of the Act. Pleaded guilty and promised compliance. As he endeavored to comply with the orders given and spent considerable money in doing so, fine was not imposed.

Six Chinamen, Lee Wah, Wah Lee, Wong Chong, Frank Lee, Low Lee and the "Princess" Laundry, Sault Ste. Marie, for non-compliance with the regulation regarding sleeping and eating apartments being separate from laundry. Each was fined $20, with the exception of the "Princess" Laundry, in which case the fine was $15.

Three explosions were reported this year, with, in one case at least, serious results. These were investigated and the causes were as given below.

At the Algoma Steel Company's Plant, Sault Ste. Marie, the explosion was caused by gas seeping through slight leaks in oven brick work, and in some unknown way becoming ignited. One man was slightly bruised.

In Campbell Bros.' Steel & Iron Works, Ottawa, gas leaked from pipes of generator and was ignited by pipe in the hands of a workman. Three men were scorched about the face.

The Energite Explosives Ltd., Haileybury, explosion was caused by fire which started in the sodium grinding room through some flinty substance in the sodium coming in contact with steel plates of machine. The fire spread to room where "Sheddite" cartridges were stored pending shipment to Copper Cliff. Five men were killed and three other employees injured.

Emergencies in certain trades caused us to issue 194 overtime permits, 18 of which were special bakeshop permits.

One of the notable developments in factory work is the rapid adoption of electricity as a motive power. It is estimated that the number of factories using electricity has increased by about 25 per cent. in very recent years. This applies particularly to larger factories.

Reports from individual inspectors show that there is practically no child labor in this province. Only a few cases have been encountered during the year and in each the law has been strictly enforced.

STATIONARY ENGINEERS' BRANCH.

The work of enforcing the Act providing that all engineers operating stationary steam plants of 50 h.p. or over and carrying more than 20 pounds pressure has proceeded quietly during the year. In spite of the fact that electricity is relacing steam in many of the large factories, the demand for competent stationary engineers is on the increase rather than the decrease. Last year 7,426 certificates were issued, being an increase of nearly 500, probably partially due to more thorough enforcement of the Act. This number included 958 who secured certificates as the result of examinations, the balance being renewals. As in previous years, the Examining Board visited many of the leading centres in the province twice in order to hold examinations.

All of which is respectfully submitted.

JAS. S. DUFF,

Minister of Agriculture

THIRTY-EIGHTH ANNUAL REPORT

OF THE

Ontario Agricultural College

AND

Experimental Farm

1912

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO)

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To His Honour SIR JOHN MORISON GIBSON, Knight Commander of the Most Distinguished Order of St. Michael and St. George, a Colonel in the Militia of Canada, etc., etc., etc.

Lieutenant-Governor of the Province of Ontario.

MAY IT PLEASE YOUR HONOUR:

The undersigned begs to present for the consideration of Your Honour the Report of the Ontario Agricultural College and Experimental Farm for 1912.

Respectfully submitted,

JAMES S. DUFF,

Minister of Agriculture.

TORONTO, 1913.

THE ONTARIO AGRICULTURAL COLLEGE, GUELPH.

HON. JAMES S. DUFF, *Minister of Agriculture, Toronto.*

FACULTY OF INSTRUCTION, 1912-1913.

(All, except the President, arranged in order of Seniority.)

G. C. CREELMAN, B.S.A., LL.D. ..... President
H. H. DEAN, B.S.A. ..... Professor of Dairy Husbandry
C. A. ZAVITZ, B.S.A. ..... Professor of Field Husbandry
J. HUGO REED, V.S. ..... Professor of Veterinary Science
H. L. HUTT, B.S.A. ..... Professor of Landscape Gardening
G. E. DAY, B.S.A. ..... Professor of Animal Husbandry
J. B. REYNOLDS, B.A. ..... Professor of English
R. HARCOURT, B.S.A. ..... Professor of Chemistry
MISS MARY URIE WATSON ..... Director of Home Economics
JOHN EVANS ..... Professor of Manual Training
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W. R. GRAHAM, B.S.A. ..... Professor of Poultry Husbandry
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MORLEY PETTIT ..... Lecturer in Apiculture
MISS GRACE GREENWOOD ..... Instructor in Normal Methods
E. W. KENDALL ..... Lecturer in Manual Training
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H. L. FULMER, B.S.A. ..... Lecturer in Chemistry
R. E. STONE, B.Sc., Ph.D. ..... Lecturer in Botany
MISS E. C. DWIGHT, B.A. ..... Acting Librarian
MISS M. A. PURDY ..... Demonstrator in Chemistry
G. H. UNWIN, B.S.A. ..... Instructor in English and German
MISS JEAN RODDICK ..... Instructor in Domestic Science
MISS ALTA DICKEY ..... Instructor in Domestic Art
MRS. F. DOUGHTY ..... Demonstrator in Domestic Art
R. R. GRAHAM, B.A. ..... Demonstrator in Physics
MISS MARY MCLENNAN ..... Demonstrator in Domestic Science
A. H. MCLENNAN, B.S.A. ..... Demonstrator in Pomology
ALEX. MCKAY ..... Demonstrator in Cheese Making
G. RICKWOOD ..... Demonstrator in Cream Separators and in Butter Making
J. SPRY, B.S.A. ..... Demonstrator in Physics
A. J. GALBRAITH, B.S.A. ..... Demonstrator in Chemistry
A. W. BAKER, B.S.A. ..... Demonstrator in Entomology
MISS G. WALSH ..... Demonstrator in Laundry and Household Administration
S. H. HOPKINS ..... Instructor in English, and Resident Master
MISS BELLE MILLAR ..... Demonstrator in Butter Making and Soft Cheese Making
A. L. GIBSON, B.S.A. ..... Demonstrator in Chemistry
A. C. MCCULLOCH, B.S.A. ..... Demonstrator in Poultry Husbandry
W. H. WRIGHT, B.S.A. ..... Demonstrator in Botany
S. R. CURZON ..... Fellow in Chemistry
D. W. GILLIES ..... Instructor in Athletics

S. SPRINGER ..... Bursar and Superintendent
S. H. GANDIER, B.S.A. ..... Secretary
W. O. STEWART, M.D. ..... Physician
MRS. K. FULLER ..... Superintendent, Macdonald Hall
MRS. CUNNINGHAM ..... Matron, Agricultural College

ONTARIO AGRICULTURAL COLLEGE
AND EXPERIMENTAL FARM
1912

To the Honorable the Minister of Agriculture:

SIR,—I have the honor to submit herewith the thirty-eighth annual report of the Ontario Agricultural College and Experimental Farm, including the report of the Macdonald Institute, for the year 1912.

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Respectfully submitted,

G. C. CREELMAN.

President.

Ontario Agricultural College.

PART I.

THE PRESIDENT.

The year 1912 has been a very successful one at this Institution. All courses were well filled, a large percentage of the students passed all the examinations, and fifty men went forward to the University examinations in May for the degree of B.S.A. Of this number, all those who did not return to their farms were immediately offered employment along professional agricultural lines, and at the present moment many more could be placed in most excellent positions if they were available for the work.

Students still continue to come to us from all parts of the world, and it will be seen elsewhere in this report that eighteen countries were represented in the student body, besides nine Provinces of the Dominion of Canada.

Agricultural Education.

In estimating the value of the College to the farmers, it is necessary to consider not only the instruction given to students who come to us from Ontario farms each year, but also the fact that thousands of matured farmers visit the College every year during June and at the time of the Provincial Winter Fair in December. And when we stop to think that every professor at the College is supplied with a stenographer and typewriter; when we realize that nearly a thousand students come here in the winter time for short courses and go immediately back to their farms; when we stop to think that over 5,000 farmers on their own farms are conducting experiments and sending their results to the Agricultural Experimental Union; when we count the bulletins and publications by the score that go out from this Institution directly to the farmers' homes; when we realize that our instructors are going through the country constantly addressing farmers' meetings: and finally, when we look at the work of our Agricultural Representatives, every-one of whom graduated from this Institution, the public may gain some idea of our work and how far reaching are the results of the work done by the Ontario Agricultural College and Experimental Farm.

Agricultural Representatives.

These men continue to do excellent work, and they thoroughly justify the action of the Government in opening up new counties each year. I have watched very carefully the work of these men and have been in constant correspondence with them. They seem to be tireless in their energy, thorough in their methods, and essentially practical with it all. In every instance the farmers have taken to them kindly, have backed up their every effort, and they can hardly realize now how they got along without a man of this type in the neighbourhood during all of these years. More than thirty of these men, and as many more assistants, are now permanently employed in as many counties, literally carrying the work of the College to every home and homestead.

The following is a list of the men engaged in this work, together with the counties in which they are located:

County.	Name.	Location.
Algoma	Smith, A. S.	Sault Ste. Marie.
Brant	Schuyler, R.	Paris.
Bruce	McKay, N. C.	Walkerton.
Carleton	Jackson, W. D.	Carp.
Dufferin	Dorrance, H. A.	Orangeville.
Dundas	Bradt, E.	Morrisburg.
Elgin	Buchanan, C. W.	Dutton.
Essex	Edwards, W. E. J.	Essex.
Frontenac	Taggart, J. G.	Sydenham.
Glengarry	MacRae, D. E.	Alexandria.
Grey	Duff, H. C.	Markdale.
Hastings	McIntosh, A. D.	Stirling.
Kent	McRostie, G. P.	Chatham.
Lambton	Porter, W. H.	Petrolea.
Lanark	Dawson, W.	Perth.
Leeds and Grenville	Smith, W. H.	Athens.
Lennox and Addington	Curran, G. B.	Napanee.
Manitoulin	Metcalf, I. F.	Gore Bay.
Middlesex	Whale, I. B.	London.
Norfolk	Smith, J. E.	Simcoe.
Northumberland and Durham	Duncan, R. S.	Port Hope.
Ontario	Tipper, R. M.	Whitby.
Peterborough	Hopkins, E. S.	Norwood.
Prince Edward	MacVannel, A. P.	Picton.
Simcoe	Laughland, J.	Collingwood.
Thunder Bay	Collins, G. W.	Fort William.
Temiskaming	Galbraith, C. A.	New Liskeard.
Victoria	Knight, A. A.	Lindsay.
Waterloo	Hart, F. C.	Galt.
Welland	Austin, R.	Welland.
York	Steckley, J. C.	Newmarket.

Agriculture in the Public Schools.

The teaching of agriculture in our schools has been attempted so often and has as often failed that for a number of years we were very nearly discouraged and had pretty nearly given up the fight. It would appear, however, that in co-operation with the Department of Education the fight was to be renewed in earnest. As a matter of fact, during the present year one hundred and thirty-five country schools in Ontario have planted school gardens and with the help of the pupils have cared for them through the growing season. We believe this has all come about and been made possible by the introduction of Teachers' Classes at this College. The Education Department has borne the expense and our instructors have done the work. About two hundred teachers come to us each year, and stay until they have at least mastered the elementary principles underlying the growing of plants. They then return to their schools to start the children thinking on such subjects as seeds, weeds, soils, insect life, and so forth. This is having its influence, and we are getting more inquiries all the time from school teachers and school trustees for information along the lines indicated above.

We believe that this is going about the work in the right way. Without teachers who know the subject, there is little hope for efficient instruction in

agriculture in the schools. With teachers who are enthusiastic and who have the knowledge, there is no doubt that a great deal of interest can be aroused in the rural school in regard to the home life and work on the farm.

The high prices obtained for farm produce of all kinds; the large amounts of money which can be obtained from the raising of poultry, bees, and small fruits, none of which require a large acreage; the absolute assurance of an apple crop of clean, sound apples by proper orchard management; in fact, the general demand in cities and towns for anything that can be raised on the farm which will bring a good price has made the farmer much more interested in his business. He is, therefore, very much keener to have his children study scientific agriculture than ever before in the history of the Province. All these things combined, therefore, would indicate that the time is ripe for a successful campaign, helped on by everybody interested, with the hope of having agriculture in some form introduced into every rural school in the Province.

Short Courses.

To the man who cannot leave his farm for months at a time, to the boy who has neither time nor means to take a longer course, and to the older man who wants to brush up on some branch of agricultural work, the short courses have come as a boon. One of the most interesting sights about the College in the months of January and February is to see hundreds of men walking out at eight o'clock in the morning and returning to their boarding-houses again at five in the evening after having spent the day studying some phase of farm work. There is no doubt that these men go home refreshed in body and mind and take up the regular routine work of the farm with more enthusiasm and more interest than they did the previous season.

This year was added a Course in Bee-Keeping, and while we did not expect more than a dozen persons to attend this special class on a special subject, to our amazement forty-four men arrived and remained for two weeks, spending their entire time in discussing the care and management of bees.

The attendance at these short courses for 1912 was as follows:

Three-month Course in Dairying	54
Two-week Course in Stock and Seed Judging	192
Two-week Course in Fruit Raising	169
Four-week Course in Poultry Raising	38
Two-week Course in Bee-Keeping	44

Stock Judging.

It is said that live stock is the right arm of Agriculture. Statistics go to prove that eighty per cent. of all the crops raised in Canada are fed to live stock. Therefore, it is extremely important that every farmer in this county should be well informed of the best types of farm animals which he feeds each year.

With the object in view, then, of instructing every one of our students in the care and management of herds and flocks, there has been inaugurated at the Provincial Winter Fair special judging classes in horses, dairy and beef cattle, sheep and swine. More than a hundred College men are engaged in these judging contests each year and great interest has been aroused in the work.

From our Senior Class each year is selected a team of five men to compete in stock judging at the International Live Stock Exposition held in Chicago in December. Just before the Show, these men are selected from all the men in the Agricultural Option in the Senior Year. This means that the entire class gets the same instruction, and the men are not known or chosen until all have been thoroughly instructed in the subject. This year the team stood sixth, there being twelve teams in the competition. The following men composed the team:

Harding, P. S. D., Lacombe, Alta.
King, H. M., Hickson, Ont.
Nixon, H. C., St. George, Ont.
Shaver, F. D., Cainsville, Ont.
Tisdale, W. H. J., Paris, Ont.

College Work and Progress.

During the year one hundred and fifty acres were added to the College Farm by purchase. Fifty acres, which had already been surrounded by the College Farm on three sides and belonging to Mr. William Hamilton, was added to the block. Just west of this farm and across the road the Government also purchased one hundred acres from Mr. George Hamilton, and the College is now in possession of both of these properties. For some years we have not been growing enough feed for our live stock. As our Classes increase in number, we have to have more animals for class purposes and necessarily must keep good representatives of all the leading breeds of farm animals. Our experimental field work has also increased, until more land was required for this purpose. On the present farm, also, we had no good orchard site, but on one of the farms purchased our Professor Crow considers that he has now a good opportunity of building up a large commercial orchard. This will be planted in the spring of 1913, the land having already been prepared and planted in rye this fall.

Two large substantial buildings are to be erected this year. The Ontario Government has appropriated money for the erection of a large dining-hall with seating capacity for 500 male students. This will be a model building in every way. We expect to have up-to-date kitchens and serving rooms, the latest style of cold storage, with butcher shop and bakery complete. The plans are now being drawn and the building will be erected during 1913.

For the first time the Federal Government has stepped in and aided Ontario Agriculture by a liberal vote. Of the $500,000 voted by the Dominion for 1912 Ontario's share was $176,000. Several phases of College work were materially assisted. A new building for the Department of Field Husbandry is being erected now at a cost of $45,000. This will relieve the present Agricultural Building, into which four Departments have been crowded for some years. In the Poultry Department a two thousand egg incubator has been established and a man placed in charge of poultry experiments and field instruction. A portion of this money has also been used to assist in the drainage campaign, in the permanent work of soil survey, and in the extension of school gardens. If this grant is continued, there is no doubt that by thus supplementing our regular provincial grants, we will be enabled to reach very many more people and in a much better way than has been possible in the past years.

Farm Drainage.

The survey work in drainage done by students of this College under the direction of the Department of Physics has again been extended during the year 1912. During this year alone 17,000 acres were surveyed by our students, making more than 2,278 miles of drains. Already our undergraduates have surveyed 61,252 acres and more applications are coming in all the time. It is hardly possible to estimate the effect of this upon the country, for these men are only paving the way to greater things. The Agricultural Representatives are laying out drains for their own people in their own counties covering thousands of acres, and the farmers themselves are attending demonstrations by our men and then doing their own drainage work themselves. Traction ditchers are coming in to do the digging and save so much in manual labor. As a result of the drainage actually being done on his place, the farmer is able to get on his land so much earlier and to bring into cultivation low fields which are rich in plant food because they have not been cropped up to this time. The report of large production soon spreads among neighbors, with the result that we shall have to put more men in the field each year to meet all the requests that come to us along this line of work.

The Experimental Union continues to do excellent work with field crops throughout the country, over 5,000 men conducting experiments and reporting annually to the College.

Perhaps no line of College work has shown greater activity during recent years than the work in poultry husbandry. This phase of the work seems to have taken on new life. Never before was there such demand for eggs for setting, for young chicks, and for older birds. We could sell thousands more eggs and birds each year if we had them, at good prices, to the farmers of the Province. We propose during the coming year to raise many more chickens with our two thousand egg incubator and to distribute them through our Agricultural Representatives to the farmers of the Province.

The bulletins prepared during the year by members of the staff and published by the Department of Agriculture are as follows:

195. "Insecticides and Fungicides" by R. Harcourt and H. L. Fulmer.
197. "Bee Diseases in Ontario" by M. Pettit.
198. "Lime Sulphur Wash" by L. Caesar.
201. "Peach Growing in Ontario; Peach Diseases" by F. M. Clement and L. Caesar.
205. "Dairy School Bulletin" by Staff of Dairy School.

Macdonald Institute.

This Institution continues to flourish, as will be seen by the report of the Director of this Department. Every available bed has been occupied in the Hall during the year, and one hundred and sixty-eight eligible students were refused because we had not room for them; besides this, fifty-two more who were tired of waiting for an opening dropped off our waiting-list. We have also had to refuse sixty-five for the Class opening after the New Year; so the need will be seen for at least additional residence in connection with this Department.

The work of Macdonald Institute is being felt now, I think, generally, not only throughout the Province of Ontario but throughout the whole Dominion of Canada. Our graduates are rapidly assuming charge of the Home Economic Departments of our leading institutions, including the teaching of domestic science and the general supervision of housework in connection with hospitals and other large institutions of a similar nature. I believe that the thorough work being

done by our most excellent staff of teachers in our Women's Department will have a marked effect upon the general tone of home life in this country in the years that are to come. The work is practical, methodical, and scientific, and should tend to systematize women's work in all branches of Home-making.

Adelaide Hoodless Memorial.

On October third representatives of the Women's Institutes of the Province gathered at Macdonald Institute to present to the College a beautiful portrait of the late Adelaide Hoodless by J. W. L. Forster. At the same time the graduates of Macdonald Institute presented a Memorial Tablet to Mrs. Hoodless to be placed in the Library in Macdonald Hall. These two gracious gifts were received on behalf of the Institution by the President of the College. The memory of Mrs. Hoodless will long live in the minds of all who knew her, and her excellent work in connection with the establishment of Macdonald Institute and Hall will stand as a real memorial of her activities in connection with Domestic Science and Art.

Changes in Staff.

In a large institution of this kind there must necessarily be many changes in the staff during the year. This is always to be regretted, but promotion is inevitable where good men are employed.

In the Department of Forestry Mr. E. J. Zavitz has been transferred to the Department of Crown Lands, with headquarters in the Parliament Buildings, Toronto. Prof. Zavitz will, therefore, no longer be Professor of Forestry at this College, but in the meantime at least he will continue to lecture to our students, and will have under his jurisdiction the forestry nurseries and the hundreds of plantations inaugurated by him while Professor here. We are pleased that he has been selected for this important post and wish him well in his new work. At the same time we trust that he may not entirely sever his connection with the College, where he has made many friends and where through his teaching and influence a number of our strong men have been led to select the profession of forestry for their life work.

A. W. Baker, B.S.A., has been appointed Demonstrator in Entomology and Zoology. He has proven a good teacher and disciplinarian.

Associate Professor T. D. Jarvis has been given a year's leave of absence to study at Oxford and elsewhere. His work is being taken by Mr. L. Caesar and Mr. Baker, assisted by Mr. G. J. Spencer who has been appointed temporarily in the work.

In the Department of Botany, Mr. W. A. McCubbin resigned his position as Lecturer to go into the Dominion Service. Mr. R. E. Stone, M.Sc., of Cornell University, was appointed in his place. Mr. Stone comes to us well equipped for his work, being a graduate of the University of Nebraska, and having spent three years in Post Graduate work at Cornell University.

Mr. W. H. Wright, who graduated in June, was appointed Demonstrator in the Department of Botany, which is now well-manned for its work.

Mr. L. D. Jackson resigned from the Chemical staff to take a position in connection with the Western Canada Flour Mills Co., in Winnipeg. Mr. G. E. Smith also resigned to join the staff of the Department of Chemistry at the Montana Experiment Station, and in August Mr. A. G. McKay, Fellow in this

Department, accepted the position of Assistant Chemist in the City Department of Health, Toronto. These men had all rendered efficient services and we were sorry to lose them. In their places were appointed Mr. A. J. Galbraith, B.S.A., Mr. A. L. Gibson, B.S.A., and Mr. S. R. Curzon. These newly appointed men have started off well and seem to be well adapted to their work.

In the Dairy Department Mr. N. S. Golding resigned his position as Demonstrator in Soft Cheese Making and entered the College Course in September. Miss Bella Miller takes his place on our regular staff. Mr. D. McMillan, of Stratford, one of the Ontario Creamery Instructors, will take part of Mr. Golding's work and will also give demonstrations in Ice Cream manufacture in the Dairy School.

In the Department of Bacteriology Mr. T. H. Lund was added as Demonstrator during the year. Mr. Lund took his first two years' work at this College some time ago, and came back in 1910 to resume his College Course. In the meantime he had been employed as an expert dairyman in connection with the State Agricultural College in Wisconsin. Mr. Lund stood first in his year on the University examinations in 1912, and we are pleased to secure his services for our Department of Bacteriology.

In the Library, Miss Dwight resigns now, her resignation to take effect Dec. 31. We regret to lose the services of Miss Dwight, who has faithfully performed her duties during the past five years. Miss Gardiner, Assistant Librarian, has been appointed to the senior position.

In the Poultry Department Mr. H. B. Webster, B.S.A., appointed Assistant in the summer of 1911, resigned to take up farming. Mr. A. C. McCulloch, B.S.A., of this year's graduating class was appointed to succeed him, and he is giving faithful service. In October, Mr. F. N. Marcellus, B.S.A., who had been very successful as a Lecturer in the Iowa State College at Ames, was appointed to our Poultry Department here and will conduct experiments and assist the Agricultural Representatives in their work in the field.

STUDENTS OF THE YEAR.

Attendance.

General Course	492
Specialists in General Course Work	8
Manual Training (One Year Normal Course)	7
Teachers' Courses (Agriculture and Horticulture, 46; Industrial Arts, 5)	51
Dairy Courses	54
Stock and Seed Judging	192
Poultry Raising	38
Fruit Growing	169
Apiculture	44
	1,055

At Macdonald Institute.

Domestic Science	236
Nature Study (79), Elementary Agriculture and Horticulture (28), Woodwork and Mechanical Drawing (13), Art and Constructive Work (40)	160
	396
Total	1,451

Analysis of College Roll (General Course), 1912.

From Ontario.

Algoma	4	Huron	8	Peterboro	4
Brant	16	Kent	12	Prescott	2
Bruce	8	Lambton	17	Rainy River	2
Carleton	12	Lanark	4	Renfrew	3
Dufferin	5	Leeds	4	Russell	3
Dundas	2	Lincoln	18	Simcoe	11
Durham	2	Middlesex	12	Thunder Bay	1
Elgin	0	Muskoka	3	Victoria	2
Essex	5	Nipissing	3	Waterloo	7
Frontenac	4	Norfolk	9	Welland	7
Glengarry	2	Northumberland	4	Wellington	38
Grenville	4	Ontario	13	Wentworth	16
Grey	6	Oxford	7	York	2
Haldimand	4	Parry Sound	1		
Halton	6	Peel	7	Total from Ontario	356
Hastings	2	Perth	5		

From Other Provinces of the Dominion.

Alberta	14	New Brunswick	1	Quebec	3
British Columbia	38	Nova Scotia	5	Saskatchewan	9
				Total from other Province	70

From Other Countries.

Argentine Republic	1	India	1	S. Africa	8
Brazil	1	Jamaica	1	Spain	2
B. W. I.	2	Japan	2	U. S. A.	17
Denmark	1	Natal	1		
England	22	Newfoundland	1	Total from other Countries	66
Holland	1	New Zealand	1		
Ireland	1	Scotland	3		

Ages and Religious Denominations.

The limits of age in the General Course, 1912, ranged from 17 to 41 years. The average age was 21.

Anglican	4	Episcopalians	116	Methodist	150
Baptists	31	Evang. Association	2	No Religion	1
Christadelphians	5	Friends	3	Presbyterian	141
Christian Scientists	1	Jewish	1	Roman Catholic	19
Congregational	5	Latter Day Saints	2	United Brethren	1
Disciples	2	Lutheran	2	Quaker	2
Dutch Reform	3	Mennonite	1		

Bachelors of the Science of Agriculture, 1912.

Aikenhead, W. M., Easton, Md., U.S.A.
Beaupre, F. C., Simcoe, Ont.
Bergey, S. A., Mannheim, Ont.
Bosman, A. M., Pretoria, Transvaal, S.A.
Boyd, F. A. W., Toronto, Ont.
Bradt, E., York, Ont.
Cherry, P. A. B., Upton-on-Severn, Eng.
Clark, T. O., Irma, Alta.
Dawson, W., Vars. Ont.
Emerson, W. W., Foxboro, Ont.
Fay, J. H., Princeton, Mass.
Gibson, A. L., Guelph, Ont.
Graham, R. R., O. A. College, Guelph.
Graham, W. L., Britannia Bay, Ont.
Green, R., Oak Leaf, Ont.
Iwanami, J., Nagano, Japan.
Lund, T. H., Chorley, England.
Macdonald, R., O. A. C., Guelph, Ont.
McCulloch, C., Epsom, Ont.
McMillan, A., Dutton, Ont.
McRae, F. C., Beaverton, Ont.
McRostie, G. P., Metcalfe, Ont.
McTaggart, A., Wellington, New Zealand.
Murray, R. H., Avening, Ont.
Palmer, C. L. S., London, England.
Petch, C. E., Toronto, Ont.
Phillips, H. L., Johannesburg, S.A.
Rebsch, C. C., Hallandale, Wisconsin, U.S.A
Reeves, F. S., Kamloops, B.C.
Reinecke, O. S. H., Nylstroom, Transvaal.
Rettie, J. E., Living Springs, Ont.
Rogers, S., Johannesburg, Transvaal, S.A.

BACHELORS OF THE SCIENCE OF AGRICULTURE, 1912.—*Continued.*

Ross, W. H., Beaverton, Ont.
Schuyler, R., Jarvis, Ont.
Shibley, C. S., Harrowsmith, Ont.
Smith, W. H., Chatham, Ont.
Sorley, J. N., Cummings' Bridge, Ont.
Southworth, W., Whitestake, Lanc., Eng.
Stevenson, L., Ancaster, Ont.,
Taggart, J. G., Lower Onslow, N. S.
Tompkins, M. N., Antigonish, N.S.
Tipper, R. M., Ashworth, Ont.
Toole, A. A., Mount Albert, Ont.
VanSickle, P. O., Trinity, Ont.
Weir, W. A., Randwick, Ont.
White, E. W., New Westminster, B.C.
Wright, W. H., Delaware, Ont.

RECIPIENTS OF ASSOCIATE DIPLOMAS, 1912.

Aikenhead, W. M., Easton, M.D., U.S.A.
Allan, J. N., Canboro, Ont.
Anderson, J. F., Raymond, Alta.
Angle, W. B., Forks Road, Ont.
Barnet, I. T., Living Springs, Ont.
Barrett, F. L., Guelph, Ont.
Bergey, J. E., Petersburg, Ont.
Blayney, C. L., Renton, Ont.
Castro, H., Buenos Aires, Arg. Rep.
Clark, G. A., Poole, Ont.
Cleeves, A. C., Hagans, B.C.
Cooke, H., Box 212, Johannesburg, S.A.
Craig, A. J., North Gower, Ont.
Crawford, J. D., Los Angeles, Cal.
Crawford, S. L., Los Angeles, Cal.
Creelman, J. M., O.A.C., Guelph, Ont.
Culverhouse, P. E., Stamford, Ont.
Davis, L. M., St. Marys, Ont.
Dorrance, H. A., Seaforth, Ont.
Downie, G. A., Cricklewood, London, Eng.
Duff, J. C., Desboro, Ont.
Duff, G. C., Cookstown, Ont.
Duncan, C. C., Jordan Harbour, Ont.
Dunlop, J., Girvan, Ayrshire, Scotland.
English, W. G., Petrolia, Ont.
Foyston, B. E., Minesing, Ont.
Freeborn, S. G., Magnetawan, Ont.
Gardner, L. J. W., Toronto, Ont.
Good, C. A., Brantford, Ont.
Grant, A., Beaverton, Ont.
Gravely, C. H., Mount Forest, Ont.
Hales, J. P., Guelph, Ont.
Halliday, D. C., Port Credit, Ont.
Hallowes, W. E., Marnhull, Dorset, Eng.
Hare, H. R., Grafton, Ont.
Harris, A. G., Kingston, Jamaica.
Hill-Tout, W. S., Abbotsford, B.C.
Hipple, L. E., Beamsville, Ont.
Hirst, G. S., Woodlands, Eastbourne, Eng.
Hogarth, E. G., Exeter, Ont.
Hotson, W. B., Avonbank, Ont.
Hunter, L. J., Westover, Ont.
Irvine, D., Habermehl, Ont.
Jackson, G. H., Guelph, Ont.
Jowsey, H. B., Toronto, Ont.
Kelleher, M., Charlottelund, Denmark.
Kingsmill, G. F., London, Ont.
Kirk, H. R., Saskatoon, Sask.
Laidlaw, C. M., Henfryn, Ont.
Lattimer, E., Burford, Ont.
Leppan, H. D., Reddersburg, O.F.S., S.A.
Lever, J., Sandhill, Ont.
Lindsay, J. E., Fergus, Ont.
Lund, Chorley, Lanc., England.
Madden, G. O., Toronto, Ont.
McLaurin, A. E., Watson, Sask.
McLennan, D. M., Lancaster, Ont.
McRostie, J. E., Metcalfe, Ont.
Mosley, L. A., Bayfield, Ont.
Nash, J. F., Windsor, Ont.
Neale, A. R., Willow Point, B.C.
Neelands, C. F., Cobalt, Ont.
Nixon, W. G., Sault Ste. Marie.
Nourse, C. B., Victoria, B.C.
Oliver, D. M., Toronto, Ont.
Paterson, F. C., Ellesmere, Ont.
Penna, L. T., Para, Brazil, S. America.
Pope, J. C., Regina, Sask.
Puleston, E. A., Southfields, London, Eng.
Robb, O., Sheffield, Ont.
Ross, W. H., Beaverton, Ont.
Ryan, L. K. V., Grimsby, Ont.
Scott, H. M., Abbotsford, Scotland.
Spalteholz, G. W., Vancouver, B.C.
Standish, E. A., Belleville, Ont.
Stansfield, N., Brighouse, Yorkshire, Eng.
Stevenson, L., Ancaster, Ont.
Stock, M. G., Summerland, B.C.
Strong, W. F., Hilton, Ont.
Teece, J. H., Enderby, B.C.
Waterhouse, F., Killiney, Ireland.
Wills, H. A., Winger, Ont.
Winslow, J. H., Chelsea Green, Ont.

FIRST CLASS MEN.

The work of the College is divided into Departments, and all candidates who obtain an aggregate of seventy-five per cent. of the marks allotted to the subjects in any Department are ranked as first class men in that Department. The following list contains the names of those who gained a first class rank in the different Department examinations, held in April, 1912, arranged alphabetically.

FIRST YEAR.

Bertram, L., in one department—English and Mathematics.
Connon, P. C., in three departments—English and Mathematics, Chemistry and Physics, and Biology.
Cory, A., in four departments—English and Mathematics, Chemistry and Physics, Biology and Agriculture.
Croskery, W. M., in one department—English and Mathematics.
Finn, R. A., in one department—Chemistry and Physics.
Garrett, F. A., in one department—English and Mathematics.
Goodman, F. L., in one department—English and Mathematics.
Higinbotham, C. F., in one department—English and Mathematics.
Hinman, R. B., in one department—Chemistry and Physics.
Hutchinson, A. E., in one department—English and Mathematics.
Jones, S. F., in one department—Chemistry and Physics.
Linklater, W. F., in two departments—English and Mathematics, and Chemistry and Physics.
Miles, A. F., in one department—Biology.
Morse, T. W., in one department—English and Mathematics.
McLaren, Q., in one department—Agriculture.
McQueen, M. J., in one department—English and Mathematics.
Neilson, J. A., in one department—Biology.
Peren, G. S., in one department—Biology.
Sands, D. R., in two departments—English and Mathematics, and Chemistry and Physics.
Smith, M. T., in two departments—English and Mathematics, and Chemistry and Physics.
Smith, D. M., in two departments—English and Mathematics, and Chemistry and Physics.
Smylie, J. S., in three departments—English and Mathematics, Chemistry and Physics, and Biology.
Varey, J. M., in two departments—English and Mathematics, and Chemistry and Physics.
Walsh, F. W., in one department—English and Mathematics.
Wilson, N. I., in one department—Chemistry and Physics.

SECOND YEAR.

Allan, J. N., in two departments—Chemistry and Physics, and Agriculture.
Freeborne, S. G., in three departments—English and Mathematics, Chemistry and Physics, and Biology.
Good, C. A., in two departments—Chemistry and Physics, and Biology.
Hirst, G. S., in two departments—English and Mathematics, and Chemistry and Physics.
Kelleher, M., in one department—Chemistry and Physics.
Nash, J. F., in four departments—English and Mathematics, Chemistry and Physics, Biology, and Agriculture.
Robb, O., in one department—Chemistry and Physics.
Scott, W. M., in one department—English and Mathematics.
Winslow, J. H., in three departments—English and Mathematics, Chemistry and Physics, and Agriculture.

SCHOLARSHIPS.

Scholarships of $20 in money were awarded for groups of subjects in first year work as follows: Highest standing with a minimum of forty per cent. of the marks of each subject, and an aggregate of seventy-five per cent. of the total number of marks allotted to the subject in the group:

Agriculture—A. Cory, Prince Albert, Sask.
Biological Science—J. S. Smylie, Westholm, B.C.
English and Mathematics—Q. McLaren, Vereenigine, Transvaal, S.A.
Physical Science—M. T. Smith, Guelph, Ont.

PROFESSIONAL DAIRY SCHOOL CERTIFICATES ISSUED DURING 1912.

Dean, F., Woodstock, Ont.	Buttermaking
Farmer, R. W., Lacombe, Alta.	Buttermaking
Halward, W. J., Cannington, Ont.	Buttermaking
McEwan, Jas. G. A., Jarvis, Ont.	Cheesemaking
McRae, F. R., Winnipeg, Man.	Buttermaking
Reid, Jas., Lucknow, Ont.	Cheesemaking
Skelton, R. J., Hickson, Ont.	Cheesemaking

MACDONALD INSTITUTE, O. A. C., 1912.

Graduates of the Two-year Normal Course in Domestic Science:

1. Miss Nellie Allely, Norland, Ont.
2. " Kathleen Coggs, 54 Boswell Avenue, Toronto, Ont.
3. " Isabel I. Craig, 368 Dufferin Avenue, London, Ont.
4. " Ada Davis, Box 78, Kincardine, Ont.
5. " Elizabeth Dobson, 105 Princess Street, St. John, N.B.
6. " Cathe Dougall, 288 Park Lane, Pretoria, S. Africa.
7. " H. Theodora Job, care J. R. Job, Freeman, Ont.
8. " Edna M. Jones, 9 Prospect Avenue, London, Ont.
9. " Ethel M. Pinel, Maynard, Ont.
10. " Isabel Shaw, Weyburn, Sask.
11. " M. May Taylor, Massie, Ont.

Graduates of the One-year Normal Course in Domestic Science:

1. Miss Ethel M. Chapman, Campbellville, Ont.
2. " Annie K. Hull, Kerwood, Ont.
3. " Roberta McNeill, 288 Gilmour Street, Ottawa, Ont.
4. " Elizabeth Maddox, Florenceville, N.B.
5. " Bessie M. Philp, Gore's Landing, Ont.
6. " Helen Plews, Picton, Ont.
7. " Lily M. Ross, 87 Bayswater Street, Ottawa, Ont.
8. " Agnes M. Stewart, 37 Woodlawn Avenue, Toronto, Ont.
9. " Mabel S. Vardon, 543 Queen Street, Toronto, Ont.

Graduates of the Housekeeper Course:

1. Miss Edith R. Black, The Manse, Harwood, Ont.
2. " Alice Boughner, Simcoe, Ont.
3. " Kathleen Cole, Clarence, Ont.
4. " Carrie Doering, 350 King Street W., Berlin, Ont.
5. " Elsie H. Fearman, 124 West Avenue S., Hamilton, Ont.
6. " Edie Hamilton, Box 412, Pretoria, S. Africa.
7. " Anna Pringle, 116 Quebec Street, Guelph, Ont.
8. " S. Louise Wright, Brampton, Ont.

Graduates of the Homemaker Course:

1. Miss Joan V. Ansley, Beamsville, Ont.
2. " Winifred Freeland, 88 Chestnut Park, Toronto, Ont.
3. " Netta Gilbertson, Simcoe, Ont.
4. " Cecile K. Gregory, Port Dalhousie, Ont.
5. " Mary McClellan, New Durham, Ont.
6. " Anna Martin, Jordan Harbor, Ont.
7. " Ruby A. Pierce, Brinsley, Ont.
8. " Gertrude Rittenhouse, Jordan Harbor, Ont.
9. " Marian T. Robertson, Walkerton, Ont.
10. " Florence Rowland, Box 192, Walkerton, Ont.
11. " Violet Schuyler, Jarvis, Ont.
12. " Minnie A. Shepherd, Primrose, Ont.
13. " Carrie G. Smith, Winona, Ont.
14. " Mary M. Stewart, Appleton, Ont.
15. " Jean Welbourn, Winterbourn, Alta.

Graduates of the Housekeeper Course who received the Professional Housekeeper Certificate as having accomplished six months' institution housekeeping:

1. Miss Margaret L. Carrick, Roseville, Ont.
2. " Jessie Elliot, Woodbridge, Ont.
3. " Winkona W. Frank, Orangeville, Ont.
4. " Lottie E. Howell, care Dr. Secord, Brantford, Ont.

SUMMARY OF ATTENDANCE IN 1912.

A.—January to June, completing the College year of 1911-1912.

(*1*) *Normal students:*

(*a*) Juniors of Two-year course 13
(*b*) Senior of Two-year course 14
(*c*) Seniors of One-year course 10

2. Housekeepers—Two-year course:	
(*a*) Juniors	12
(*b*) Seniors	8
3. Homemakers—One-year course	46
4. Short Course in Domestic Science—Three months:	
(*a*) Winter term students	36
(*b*) Spring term students	19
5. Short Course in Sewing—Three months:	
(*a*) Winter term students	7
(*b*) Spring term students	7
6. Optional students	3
7. Student-workers	3
8. Public School students	64

B.—September to December, opening the College year of 1912-1913.

1. Normal students:	
(*a*) Juniors of Two-year course	12
(*b*) Seniors of Two-year course	14
(*c*) Seniors of One-year course	10
2. Housekeepers—Two-year course:	
(*a*) Juniors	6
(*b*) Seniors	12
3. Homemakers—One-year course	41
4. Short Course in Domestic Science—Three months	26
5. Optional	3
6. Student-workers	2
7. Public School students	65
Total	433

C.—Students counted in both above lists:

1. In long courses	40
2. In Public School classes	28
	68
D.—Total number of students in 1911	446
E.—Total number of students in 1912	365

MEDALS, SCHOLARSHIPS AND PRIZES AWARDED APRIL, 1912.

The George Chapman Scholarship.

A prize of $20 in books awarded on the work in English of the first two years. The three divisions of the work under the English Department are taken into consideration in awarding the prize, namely, English Literature, English Composition and Public Speaking. Winner in 1912: J. H. Nash, London, Ont.

Prizes.

Three prizes of the value of $10 each in books were awarded as follows:

One to the second year student who composed and read before a Committee the best essay on the subject assigned for the year, viz., "The Outlook for Fruit Growing in Ontario," or "The Outlook for Stock Raising in Ontario." G. S. Hirst, Woodlands, Eastbourne, England.

One to the student who stood first in general proficiency on first and second year work—Theory and Practice—J. H. Nash, London, Ont.

One to the student who ranked highest in general proficiency and obtained first-class honors in his major subjects in the fourth year. Winner: T. H. Lund, Chorley, England.

Special Prizes.

Second Year prize in English: H. M. Scott, Abbotsford, Scotland.
Third Year prize in English: G. T. Spencer, India.

Medals.

Governor-General's Silver Medal: First in General Proficiency, first and second year work, 1911-1912. Winner: J. H. Nash, London, Ont.

Barton-Hamer Gold Medal: Awarded to that member of the O.A.C. International Live Stock Judging Team securing the highest number of marks in the Students' Judging Contest, held annually at Chicago. Winner: P. S. D. Harding, Lacombe, Alta.

RESULTS OF JUDGING COMPETITION.

Winter Fair, 1912.

Horses.	*Beef Cattle.*	*Dairy Cattle.*
1. Harding, P. S. D.,	1. Webster, C. A.	1. Pope, J. C.
2. Bramhill, G. G.	2. Mitchell, A. R.	2. Davison, W.
3. Tawse, W. J.	3. Nixon, W. G.	3. Hare, H. R.
4. Duff, G. C.	4. Neff, E. S.	4. Hinman, R. B.
5. McRostie, J. E.	5. Tregillus, C. A.	5. Irvine, D.
6. McElroy, H. M.	6. Tawse, W. J.	6. Lawrence, J. W.
7. Elliott, G.	7. Cooke, H.	7. Riach, H.
8. Stewart, P.	8. Fairles, T. F.	8. (Outsider.)
9. Dougall, R.	9. Diaz, R.	9. Wilson, G.,
10. Gerow, H. B.	10. McElroy, H. M.	10. Binnington, D. J.

Sheep.	*Swine.*
1. Shields, W.	1. Bergey, J. E.
2. Hinman, R. B.	2. McLaurin, A. E.
3. Kelleher, M.	3. Neelands, C. F.
4. Knapp, J. S.	4. Knapp, J. S.
5. Grange, J. B.	5. Wilson, G.
6. Neelands, C. F.	6. Lattimer, J. E.
7. Thompson, W.	7. Duff, G. C.
8. Lindsay, J. F.	8. Francis, T. E.
9. Dougherty, J. L.	9. Allan, J. N.
10. (Outsider.)	10. Abraham, R. H.

I have the honour to be,

Your obedient servant,

G. C. CREELMAN.

Guelph, December 28, 1912

FINANCIAL STATEMENT, 1912

COLLEGE DEPARTMENT.

Expenditure.

Salaries and wages	$75,140 50
Servants' pay list	3,923 30
Meat, bread, groceries, laundry, engine room supplies and fuel	34,690 17
Advertising, printing, postage and stationery	3,975 24
Expenses, short courses	1,682 54
Temporary Assistance	1,097 33
Student labor	3,977 30
Travelling Expenses and Extra Lectures	1,818 95
Library	1,948 24
Scholarships	120 00
Telephone service, rents, etc.	474 60
Furnishings and repairs	4,789 49
Sewage	540 00
Contingencies	1,287 06
Maintenance, 5 laboratories and gymnasium	7,744 92
Total Expenditure	$143,209 64
Less Revenue	39,218 02
Net Expenditure	$103,991 62

Revenue.

Board	$22,613 00
Tuition and Laboratory Fees	15,079 00
Chemical Analyses	209 94
Rent of Rooms	119 50
Rent of Cottages	300 00
Rent of Post Office boxes	40 50
Supplemental examinations	202 00
Fines and breakages	567 33
Sundries	86 75
Total Revenue	$39,218 02

Student Labor, 1912.

(12 months)

Total per Month.		*To Different Departments*	
October 13th to 31st	$ 461 14	College	$ 492 13
November & December	874 13	Chemical	20 86
January	631 59	Botanical	60 37
February	567 22	Bacteriological	66 46
March	462 60	Physical	39 12
April	101 70	Entomological	62 87
May	68 51	Gymnasium	22 99
June	208 72	Library	39 91
July	100 10	Macdonald Institute	23 51
August	20 80	Nature study	13 64
September 16th to Oct. 12th	480 79	Farm Dept.	885 30
		Experimental Dept.	828 88
		Dairy Dept.	45 93
		Poultry Dept.	311 87
		Horticultural Dept	652 60
		Mechanical Dept.	307 36
		Apiculture Dept.	103 50
	$3,977 30		$3,977 30

MACDONALD INSTITUTE AND HALL.

Expenditure.

Salaries and wages	$18,674 00
Servants' pay list	2,151 13
Meat, bread, groceries, furnishings, repairs, engine room supplies, fuel and labor on grounds	14,099 85
Maintenance of Laboratories in Institute	3,097 89
Library and Stationery	744 04
Total Expenditure	$38,766 91
Less Revenue	23,795 88
Net Expenditure	$14,971 03

Revenue.

Board	$15,770 05
Tuition and Laboratory Fees	7,906 00
Supplemental Examinations	20 00
Fines, breakages, etc.	49 78
Sundries	50 05
Total Revenue	$23,795 88

FARM DEPARTMENT.

Expenditure.

Permanent improvements	$494 95
Wages of men, foreman and stenographer	8,242 62
Purchase and maintenance of stock	9,396 82
Farm maintenance, including repairs, blacksmithing, binder twine, seed, furnishings, fuel, light, advertising, printing, stationery, tools, implements, etc.	2,689 68
Contingencies	308 34
Total Expenditure	$21,132 41
Less Revenue	9,247 87
Net Expenditure	$11,884 54

Revenue.

Sale of Cattle:—		
19 Calves at from $1.00 to $125.00	$ 405 00	
9 Cows at from $40.00 to $65.00	480 00	
4 Heifers at from $40.00 to $50.00	185 00	
6 Cattle, 7,115 lbs. at $7.50 cwt.	533 62	
3 Carcasses, 1,759 lbs. at from $5.00 to $10.00 cwt.	146 83	
1 Bull	40 00	
		$1,790 45
Sale of Pigs:—		
113 Hogs, 19,099 lbs. at from $6.00 to $8.30 cwt	1,452 46	
24 Sows at from $8.00 to $25.00	462 00	
6 Boars at from $8.00 to $10.00	58 00	
35 Pigs at from $2.50 to $6.00	171 50	
		2,143 96
Sale of Sheep:—		
5 Ewes at $3.00	15 00	
6 Lambs at $5.00	30 00	
1 Ram Lamb	12 00	
		57 00
Sale of Milk:—		
11,750 quarts at 4c.	470 00	
96,445 lbs at $1.60 cwt.	1,543 12	
3,041.08 lbs. fat at from 26.5 to 36.5	959 98	
		2,973 10

Service of Animals	142 00
Sale of 1 old horse	150 00
Sale of 2 bushels barley at 1.25	2 50
Sale of 666 bags potatoes at 1.00	666 00
Feed of 23 horses 1 year at 50.00	1,150 00
Sundries	172 86
Total Revenue	$9,247 87

EXPERIMENTAL DEPARTMENT.

Expenditure.

Permanent improvements	$1,101 10
Assistant, specialist in plant breeding, stenographer, foreman, teamsters and laborers	11,394 81
Seeds, manure and special fertilizers	859 21
Furnishings, implements, repairs, blacksmithing, etc.	822 93
Printing, postage, stationery and contingencies	370 09
Feed of horses	200 00
Purchase of horse	270 00
Total Expenditure	$15,018 14

DAIRY DEPARTMENT

Expenditure.

Permanent improvements	$115 00
Wages, including foreman, cheesemaker, buttermaker, engineer, stenographer and bookkeeper, assistant and official tester of dairy cattle	2,976 00
Purchasing, hauling and manufacturing milk into butter and cheese	2,536 16
Furniture, furnishings, repairs, etc., laboratory expenses, gas, chemicals, etc., and contingencies	999 44
Fuel and light	298 34
Total Expenditure	$6,924 94
Less Revenue	3,355 64
Net Expenditure	$3,569 30

Revenue.

Sale of cheese, 15,329 5-16 lbs at from 12c to 60c		$2,374 02
Sale of butter, 260 lbs at from 15c to 30c		67 23
Sale of cream, 1,829½ qts. at 20c	$365 90	
1 pt. Devonshire cream	25	
		366 15
Sale of fat, 340 lbs. at from 29c to 33c		108 14
Sale of skim milk, 58,126 lbs. at 20c cwt		116 25
Sale of buttermilk, 37,925 lbs. at 20c cwt.		75 85
Sundries		8 00
Rent of houses		240 00
Total Revenue		$3,355 64

DAIRY SCHOOL.

Expenditure.

Wages of instructors, engineer, janitor, stenographer and bookkeeper	$2,059 40
Cleaning, painting, repairs and contingencies	146 24
Dairy appliances, separators, vats, expenses cheese and butter judges, inspecting factories, etc	431 05
Advertising, printing, postage, stationery, books, papers, etc	161 57
Fuel and Light	597 67
Purchase of milk for cheesemaking and cost of hauling milk and cream	2,644 96
Total Expenditure	$6,040 89
Total Revenue	2,204 05
Net Expenditure	$3,836 84

REVENUE

Sale of cheese, 7,869 11-16 lbs. at from 13c to 60c	$1,247 68
Sale of butter, 7 lbs. whey butter at 15c	1 05
Sale of cream, 562 qts. at 20c	112 40
Sale of fat, 1,609.64 lbs at from 35c to 41c	606 57
Sale of buttermilk, 45,175 lbs. at 20c	90 35
Sale of skim milk, 22,050 lbs. at 20c. cwt.	44 10
Fees	84 00
Sundries	17 90
Total Revenue	$2,204 05

POULTRY DEPARTMENT.

EXPENDITURE.

Wages of assistant, stenographer and temporary assistance	$1,699 25
Furnishings and repairs	949 69
Purchase of stock	199 10
Fuel, light and contingencies	332 10
Experiments with incubator, fattening and feed	3,495 58
Feed of horse	50 00
Total Expenditure	$6,725 72
Less Revenue	4,629 76
Net Expenditure	$2,095 96

REVENUE.

Sale of live poultry:—		
628 live birds for	$ 915 00	
132 live chicks at 10c	13 20	
		$928 20
Sale of dressed poultry:—		
7,124 15-16 lbs. at from 12c to 50c	1,204 41	
6 pairs broilers at 1.00	6 00	
		1,210 41
Sale of eggs for hatching:—		
727 2-3 settings for	882 00	
12,395 eggs at from 2c to 10c	606 95	
		1,488 95
Sale of eggs for domestic use:—		
3,382 11-12 dozen at from 10c to 50c		1,001 00
Sale of 3 egg boxes at 40c		1 20
Total Revenue		$4,629 76

HORTICULTURAL DEPARTMENT.

EXPENDITURE.

Permanent improvements	$493 62
Head gardener and foreman, assistant in plant breeding, assistant and night foreman, teamsters, assistant gardener, stenographer and laborers	7,721 54
Manure, trees, plants, bulbs, seeds, cold storage experiments, implements, tools, furnishings, repairs and contingencies	2,598 50
Fuel and light	819 50
Wax fruit models	142 00
Feed of horses	300 00
Purchase of team	450 00
Total Expenditure	$12,525 16
Less Revenue	1,154 86
Net Expenditure	$11,370 30

REVENUE.

Sale of fruit and vegetables as per statements rendered monthly	$1,154 86

MECHANICAL DEPARTMENT.

EXPENDITURE.

Salary of foreman	$900 00
Tools, furnishings and repairs	249 24
Total Expenditure	$1,149 24

APICULTURE DEPARTMENT.

EXPENDITURE.

Equipment and maintenance	$1,249 83
Less Revenue	98 70
Net Expenditure	$1,151 13

REVENUE.

Sale of honey 900 lbs. at from 10½c to 11½c	$98 70

SOIL PHYSICS DEPARTMENT.

EXPENDITURE.

Services and expenses of temporary assistants in connection with Farm Drainage Demonstrations	$3,999 77

FORESTRY DEPARTMENT.

EXPENDITURE.

Contingencies	$1,425 43

SUMMARY.

	Expenditure.	Revenue.	Net. Expenditure.
College	$143,209 64	$39,218 02	$103,991 62
Macdonald Institute and Hall	38,766 91	23,795 88	14,971 03
Farm	21,132 41	9,247 87	11,884 54
Experimental	15,018 14	.....	15,018 14
Dairy	6,924 94	3,355 64	3,569 30
Dairy School	6,040 89	2,204 05	3,836 84
Poultry	6,725 72	4,629 76	2,095 96
Horticulture	12,525 16	1,154 86	11,370 30
Mechanical	1,149 24	.....	1,149 24
Apiculture	1,249 83	98 70	1,151 13
Soil Physics	3,999 77	.....	3,999 77
Forestry	1,425 43	.....	1,425 43
	$258,168 08	$83,704 78	$174,463 30

S. SPRINGER,
Bursar and Superintendent.

PART II.

THE PROFESSOR OF ENGLISH.

To the President of the Ontario Agricultural College:

SIR,—I have the honor to present herewith my eighteenth annual report in the Department of English.

This department being one entirely for instruction, without affording opportunities for investigation, there is little to report from year to year except changes in methods of instruction. Previous reports, especially that for 1910, have given full accounts of changes in our course, chiefly in the direction of instruction in Journalism and in Public Speaking. These branches of our work are now apparently on a satisfactory basis, and no changes have been found necessary. The teaching staff of the department are the same as last year, and I am glad to be able to bear witness to their continued efficiency.

Respectfully submitted,
J. B. REYNOLDS.

PART III.

THE PROFESSOR OF ENTOMOLOGY AND ZOOLOGY.

To the President of the Ontario Agricultural College:

SIR,—I have the honor to present my seventh annual report on the work of the Department of Entomology and Zoology.

TEACHING AND OTHER FORMS OF INSTRUCTION.

During the year regular lecture and laboratory work as outlined in the College Calendar has been carried on as usual with, however, such improvements as experience has suggested. In addition to these duties members of the staff have assisted in the short courses in Horticulture, Apiculture and Poultry, and taken their share of the spring and summer courses for the teachers in training. One member, Mr. Baker, was constantly in attendance at the "Information Bureau" on insect pests during the June excursions to the College. He had also charge of the Department's exhibit of injurious insects at the Toronto Exhibition. Mr. Caesar spent some time on the C.P.R. Better Farming Special Train, and attended Fruit Institutes in various parts of the Province whenever he could do so without interfering with the regular work. He also gave two addresses at the Fruit Growers' Association in Toronto, one on the "Common Insect Pests and Diseases of the Orchard," and the other on "Experimental Work on Yellows and Little Peach during the year 1912." At the annual meeting of the Entomological Society of Ontario he contributed a paper on "Insects of the Season in Ontario" and another on "Some New or Unrecorded Orchard Pests." Several other extra mural addresses have been given by myself and colleagues during the year, it being our desire to foster an interest in the study of insect life and other phases of nature wherever time and opportunity make this possible.

Correspondence.

The number of correspondents has continued to grow with gratifying rapidity and requires an increasing amount of time and attention. The large number of district representatives, who are all graduates of this College, and also the public school teachers who have spent a term or more here, have had much to do with this increase in correspondence, although even apart from them it has grown greatly.

Publications.

Two bulletins and a revised spray calendar have been published by Mr. Caesar. Bulletin 198, entitled "The Lime Sulphur Wash," gives the latest information on the preparation and use of this valuable spray mixture. Bulletin No. 201, Part II., deals with the Diseases of Peach Trees in Ontario, and contains along with other diseases, a careful account of Peach Yellows and Little Peach. Both bulletins are well illustrated. Two Press Bulletins were sent out, one entitled "Break up the Old Pasture Fields" by myself, and the other, "The Hessian Fly," by Mr. Caesar. The ravages of wireworms, white grubs and grasshoppers, all of which breed in old pastures, and the serious losses from the Hessian Fly caused us to resort to this plan of giving information on the best known methods of controlling these pests and of reaching the farming community throughout the Province. Several articles on such subjects as Aphids, Codling Moth, Buffalo Carpet Beetle, and various other insects, have been contributed to the fruit magazines or other papers from time to time as they have been solicited or as they seemed likely to be of special value.

Apparatus and Collections.

No costly additions have been made to our laboratory apparatus during the year, but several good charts which were much needed for class-room purposes have been purchased. We have also prepared a good many lantern slides illustrating the life history and work of our most injurious insects and diseases. These slides will help us greatly to make instruction to farmers and others along these lines clearer and more easily remembered. Many well mounted and properly labelled insects have been collected during the season for the College collection in addition to a larger supply than usual of the common insects which we find it necessary to keep on hand to supplement in laboratory work the collections which each student is required to make for himself. At the request of several of the district representatives a number of cases of injurious insects were prepared for their use.

Investigation Work.

The investigation work of the Department was done by Mr. Caesar and Mr. Baker.

Aphids. Black leaf 40 combined with lime-sulphur applied to apple trees just before the buds burst, which was shortly after the aphid eggs were hatched, gave excellent results, destroying almost every aphid. On check trees the aphids were numerous. As this combination was somewhat too costly an attempt was made to discover cheaper mixtures, but none that were satisfactory were discovered.

Blister Mite. There was some uncertainty whether to get good results against Blister Mite, it was necessary to wait until the buds had begun to burst.

To test this forty large badly infested apple trees thirty-five years old and upwards were sprayed on one side on April 25th, nearly two weeks before the buds were ready to burst and on the other side in May as they were bursting. The work was very thoroughly done. Examination in August showed that both sprayings had given almost perfect results and that it was not necessary to wait until the buds were bursting to spray for this pest. The lime-sulphur mixture was used.

Deformed Apples. Several trips were made to a Spy orchard in which every year there are a number of badly deformed apples. Observations, continued now for three seasons, have shown that three insects not previously reported in Ontario as troublesome in this way were the cause of these deformities and of the killing of the leaves and terminal parts on the suckers that sprang up from the crown. The insects were Lygidea mendax, Paracalacoris colon and Neurocolpus nubilus, all belonging to the Hemiptera. The injuries are done by the young bugs puncturing and sucking the fruit, leaves and twigs, soon after the blossoms fall. Feeding on leaves and twigs continues longer than on the fruit. A tobacco wash applied shortly after the blossoms fall would probably destroy these insects.

Rose Chafer or Rose Bug. Observations on the effect of spraying for this pest with 4 lbs. Arsenate of lead to 40 gallons of water sweetened with 1 gallon or more of molasses showed that many of the insects had been killed by this mixture which is much better than any other yet tested.

Cherry Fruit Flies. While making some observations on the ordinary species of Cherry Fruit Fly which in some districts does very great damage to Montmorency cherries much more damage than the Plum Curculio does—Mr. Caesar discovered that there was another closely allied species (Rhagoletis fausta) that was also destructive in some districts. He hopes to make a study of these insects next season and test methods of control.

Apple Maggot or Railroad Worm. Mr. Chas. Good, one of our Students in Entomology, is continuing the work begun by Mr. W. A. Ross on this insect. Considerable progress has been made but not so much as would have been if the weather had not been so wet. Another season's work will be necessary to complete the investigation.

For a fuller account of these and other insects of the season, reference should be made to the Forty-third Annual Report of the Entomological Society of Ontario of the year 1912.

Arsenite of Zinc. This is a fine grayish white powder which has been proposed as a substitute for Arsenate of lead as being cheaper, easier to use and quite as effective. Tests on Codling Moth and Potato beetles at Guelph gave as good results as Arsenate of Lead. Mr. Beckett of Hamilton, used 100 lbs. of the poison and was well pleased with the results. It was combined in all these tests with lime-sulphur. The statements, however, of men from the United States, who report that its use sometimes results in burning of foliage make it doubtful whether it will prove a worthy substitute for Arsenate of lead. In any case we shall not recommend its use without fuller tests under various conditions of temperature and moisture.

Peach Yellows and Little Peach. Mr. Caesar gave almost all his attention to work on these diseases for more than three months, and for this purpose made his headquarters in the Niagara district. A careful study of the symptoms of the diseases was made, assistance and encouragement to the inspectors given, demonstration meetings for the growers held and a series of experiments planned

and carried out to test how and when the disease spread and the length of time from a tree is inoculated until it shows the characteristic symptoms. It will take several years before the results of these experiments will be definitely known. A comprehensive account of this work will be published in the report of the Fruit Growers' Association of Ontario for the year 1912.

SOME LITTLE KNOWN BUT DESTRUCTIVE DISEASES REPORTED.

By Mr. Caesar.

Raspberry Yellows. This disease which is often called Raspberry Leaf Curl and is characterized by the curling and crumpling of the leaves, which at first are dark green with a metallic hue but later turn yellow, has been found in many plantations in the Niagara district for several years. Plants once attacked are useless and should be promptly dug out and burned. Care should also be taken to choose only healthy plants from an uninfested plantation when setting out new canes. The disease is easily recognized by the very conspicuous curling of the leaves. The cause is unknown.

Gooseberry Disease. In a garden at Burlington about five per cent. of the twigs of gooseberries were found to have wilted and died. Specimens were sent to Geneva to the Botanical Department and word was sent back that the disease was caused by an unnamed fungus which entered through small openings made by a tiny insect that mined in the cambium layer. It is difficult at present to recommend any method of control.

Mosaic Diseases of Tomatoes. In many parts of the Niagara district a disease of tomatoes was observed which causes the leaves to be mottled with alternately dark and light green areas and often to become long, narrow and spindling. Affected plants do not yield well. Care should be taken to sterilize the seed beds or to replace the old soil in these with fresh, to select seed only from plants that are known to be healthy and, if possible, to set out plants only in land where tomatoes have not been grown for some years. The cause of the disease is not known.

Pine Branch Disease. From Lambton County a disease on Scotch pine branches has been sent in with the statement that it was killing all the affected branches. The disease takes the form of globular enlargements or swellings on the branches, some of these being about two inches in diameter, others not more than half an inch. The branches forwarded were all small. Specimens were sent to Washington and were identified as a species of Peridermium, probably P. cerebrum. No satisfactory remedy can be recommended without further study of the disease.

Respectfully submitted,

CHARLES J. S. BETHUNE.

PART IV.

THE PROFESSOR OF BOTANY.

To the President of the Ontario Agricultural College:

SIR,—I have the honor to submit my second annual report for the Department of Botany.

INSTRUCTION.

Lectures and laboratory work in Botany have been given to the regular students of all years. Special lectures have been given to the short course students in Stock and Seed Judging, Horticulture, and Apiculture, and to the spring and summer classes in Nature Study and Elementary Agriculture.

NEW EQUIPMENT.

During the past year the facilities of the department for research work have been greatly increased by building in the attic a well lighted, up-to-date, research laboratory and an excellent studio and dark room for micro-photography. It is the intention to equip the laboratory with an autoclave and all the apparatus necessary to carry on investigational work in Plant Pathology.

Four new microscopes for the use of the Third and Fourth Year Students have been added to our equipment, and an aquarium for the culture of Algae has been installed in the laboratory for Plant Physiology.

CORRESPONDENCE.

The correspondence of the department continues to increase. During the past season 1911-1912, large numbers of letters were received inquiring about weeds, weed seeds and fungus diseases, and numerous specimens of plants and fungi were sent in for identification. In the spring months numerous samples of clover and grass seed were submitted for purity test. This work now takes a large part of time of the staff of this department, especially during the spring and summer months.

WEEDS.

Analysis of the correspondence received during the past twelve months indicates that the following weeds have attracted most attention during the past year: Twitch Grass (*Agropyron repens*), Wild Mustard (*Brassica arvensis*), Field Bindweed (*Convolvulus arvenis*), Salad Rocket (*Eruca sativa*), in Alfalfa, Wild Barley (*Hordeum jabatum*), Bladder Campion (*Silene latifolia*), Perennial Sow Thistle (*Sonchus arvensis*), Cow Cress (*Lepidium campestre*), Field Chickweed (*Cerastium arvense*) and Russian Thistle (*Salsola Kali*, var. *tenuifolia*).

FUNGUS DISEASES.

The frequent and prolonged wet periods of the past summer (1912) produced conditions favorable to the development and spread of fungi, and consequently, numerous fungus diseases become prevalent in Ontario. The inquiries received

concerning plant diseases were therefore unusually numerous. The following are among the diseases on which information was supplied: Late Blight and Rot of Potatoes (*Phytophthora infestans*), Apple Scab (*Venturia Pomi*) and Pear Scab (*Venturia Pyrina*) in unsprayed orchards, Orange Rust of Blackberry (*Gymnoconia Peckiana*), Late Blight of Celery (*Septoria Petroselini var. Apii*), Leaf Blotch or Black Spot of Maple (*Rhytisma Acerinum*), Peach Leaf Curl (*Exoascus deformans*), Alfalfa Leaf Spot (*Pseudopeziza Medicaginis*), Potato Scab (*Oospora scabies*), Black Rot Canker (*Sphaeropsis malorum*), Dry Rot or Stem Blight of Potatoes (*Fusarium Oxysporum*), Currant Anthracnose (*Pseudopeziza Ribis*), Brown Rot of Plums (*Sclerotinia fructigena*), Hollyhock Rust (*Puccinia malvacearum*), Raspberry Cane Blight (*Coniothyrium fuckelii*), Stem Blight of Asters (*Fusarium sp.*), Cedar Apple Rust (*Gymnosporangium sq.*), Apple Bark Fungus (*Valsa ambiens*), Raspberry Yellow, the cause of which is unknown, it is a serious disease which seems to be on the increase in Ontario. The Mosaic Disease of Tomatoes is another little known disease which was reported as occurring in Ontario this year.

Ginseng Diseases in Ontario.

In order to prepare an address on Ginseng Diseases, which was given before the Ginseng Growers' Association of Ontario, the writer visited several of the leading ginseng growers and inspected their ginseng gardens with the object of gathering as much information as possible about the diseases of ginseng in Ontario. Judging by the information received and the examinations made the following are the most serious diseases of ginseng in Ontario: Alternaria Blight (*Alternaria Panax*), Rust, Fibre Rot or End Rot (*Thielavia basicola*), and Soft Rot (a bacterial disease).

Alternaria Blight (*Alternaria Panax*). This is a very common and very widespread disease of ginseng. It is found in nearly every ginseng garden, and once it becomes established its eradication is almost impossible. This disease attacks all parts of the plant above ground. The first indications of the disease are dark-brown spots upon the stems; later spots appear upon the leaves. These are half an inch or more in diameter, and in the early stage have a water-soaked appearance, but later become dry and papery with broad rusty-brown margins. Very often these spots run into each other and the whole leaf becomes involved and withers. The stems often rot and fall over. If the diseased stems are examined upon the surface there will be noticed a velvety brown coating due to the presence of immense numbers of fungus spores.

Remedies. Sanitary measures such as the removal and the destruction of the diseased tops, the burning over of the beds in the autumn or the spraying of the surface with a strong copper sulphate solution (1 pound of copper sulphate to 5 or 10 gallons of water) will do much to hold this disease in check, but cannot be relied upon to present loss when conditions favorable to the development of the fungus occurs. Protecting plants from infection by the Alternaria Fungus by spraying them with some good fungicide is the only sure way of preventing loss. Growers differ in their opinion as to what is the best fungicide for spraying ginseng. In the United States, Bordeaux mixture has been found to give good results. Pyrox, which is a combined fungicide and insecticide being constituted largely of Bordeaux and Lead Arsenic mixed together, has been found by some growers to give better results than Bordeaux mixture. Mr. Peter Menzies, the veteran ginseng grower in Ontario, claims to have had good results by spraying

with lime-sulphur of the strength of 1 gallon to 40 gallons of water. Whatever fungicide is used, the success will largely depend upon its thorough and timely application. The time to spray to prevent Alternaria Blight is just before a rain and not just after a rain as many growers seem to think. The fungus which causes the Blight only gains entrance to the plants during rainy and cloudy weather when the plants are saturated with moisture and thus it is important if infection is to be prevented to have the plants covered with a fungicide at such times. Thorough work can only be done with a nozzle giving a fine mist and with a pump which gives a pressure of not less than 60 pounds. Professor Whetzel of Cornell University says, "The most important times at which to spray to prevent Alternaria Blight are just when the plants are coming up and expanding; when the leaves are fully expanded; just before the blossoms open; just as the berries begin to enlarge and just before the berries begin to color."

Rust, Fibre Rot or End Rot. (*Thielavia basicola.*) This is another very serious fungus disease of ginseng; it sometimes causes more loss than the Alternaria Blight. The symptoms of this disease vary very much with the age of the plants and the character of the weather. In seedlings the most noticeable symptoms during a dry season are the gradual change in the color of the leaves from dark healthy green to a sickly light green followed by a premature coloring in shades of red and yellow. Later the leaflets wither and the stems wilt. In damp weather the color changes are not so marked and wilting is more sudden, the seedlings toppling over and the tops remaining green. If the roots of the diseased seedlings are examined, the fibres will be found to be brown and rotted. Very often all the fibres of a root will be completely destroyed giving the root a trimmed up appearance. On the larger roots rust spots are noticed which are frequently pocks and scars. These are often superficial but sometimes extend deep into the flesh of the roots.

Control. The applications of acid phosphate at the rate of from 1,000 to 2,000 pounds per acre are recommended for the control of this disease. Acid phosphate is now quite extensively used by the ginseng growers in the United States and has been found by many to greatly reduce the amount of rust. Sterilization of the soil with steam or formalin is recommended for seedling beds or for old beds that are to be reset.

Soft Rot. This is thought to be a bacterial disease. The leaves of the plants attacked by Soft Rot lose the dark green color so characteristic of healthy plants and become thin and delicate and tinged with red and yellow as though maturing for the autumn and finally the leaves wilt and the stems droop over. If the roots of plants showing the early symptoms of the disease are dug up some part will be found to be rotted. The rot may be at the crown or on the fibres and large rootlets. As the disease advances the whole root becomes soft, ill-smelling and rotten. This disease is usually most destructive during wet periods in July and August, and is especially a disease of ginseng beds which are not properly underdrained.

Control. All plants showing signs of rot should be removed from the beds as soon as they are noticed. Care should be taken to see that the beds are properly tile-drained. If the disease becomes destructive in a bed, remove the plants and sterilize the soil with steam of formalin.

Investigation Work.

During the past twelve months the following research work has been carried on: Co-operative experiments in weed eradication; studies of the life history of

Sclerotinia fructigena, the fungus which causes the brown rot of stone fruits; co-operative experiments in spraying plums to test the relative efficiency of lime-sulphur and Bordeaux mixture in controlling Brown Rot. Under the directions of the Department, Mr. Cleeves, a fourth year student in Biology, has continued the experiments in the destruction of weeds by chemicals and Mr. J. B. Grange, a fourth year student in Agriculture, has made a study of the root systems of Perennial Sow Thistle and Twitch Grass.

Information Bureau.

During the month of June a Bureau of Information was maintained for the benefit of the farmer visiting the College. Information was given concerning the control of weeds, insects and fungus diseases. Mr. Wright was in charge of the Botanical work of the Bureau and was kept busy answering the numerous inquiries of the excursionists who called for information or to have weeds identified.

Outside Work.

I have acted as editor of the Ontario Natural Science Bulletin and contributed a number of short articles on weeds and fungus diseases to the agricultural press. In December I had the pleasure of attending the annual meeting of the American Association for the Advancement of Science at Washington, D. C. In June I gave an address on Weeds to the West York Farmers' Institute at Woodbridge, and held a demonstration in Mustard Spraying at Norwood in Peterboro County. In May, Mr. McCubbin accompanied Prof. Crow to Lambton to investigate the seriousness of the winter injury to peach trees. In September I gave an address in Toronto before the Ginseng Growers' Association of Ontario on the Diseases of Ginseng in Ontario.

Herbarium.

During the fire in the Biological Building last winter the herbarium became filled with dense smoke and part of it drenched with water. Many of the mounted plants were soaked and nearly all the mounts blackened by smoke. This made it necessary to go over all the collections and clean, remount and relabel nearly all the specimens. This work was accomplished during the summer months and the herbarium is now in good condition again.

A large number of new specimens have been added. Mr. N. H. Cowdry of Waterdown, Ontario, kindly presented to the Department his extensive collection of Canadian plants. These when added to the herbarium will fill in many gaps and make the College collection more complete and useful. The reference collection of Fleshy Fungi has also been increased by the addition of many new species collected by Mr. Stone. A list of the new species is here appended.

LIST OF FLESHY FUNGI ADDED TO THE HERBARIUM.

Cortinarius alboviolaceous. Pers. Dairy Wood, Guelph. Sept. 10, 1912.
Lepiota cristata, A. and S. Campus, O. A. C., Sept. 15, 1912.
Lepiota acutasquarrosa. Weinm. Campus, O. A. C., Sept., 1912.
Mycena stannea, Fr. Exp. Plot Bush, Sept., 1912.
Marasmius rotula (Schop), Fr. Woods, Guelph, Sept., 1912.
Paneolus companulata, Linn. Woods, Guelph, Sept., 1912.
Collybia platyphylla, Fr. Guelph.
Crepidotus mollis. Schaeff. Dairy Bush, O. A. C.
Tremella albida, Hud. South of Dairy Bush.
Clavaria vermicularis (Scop), Fr. Dairy Bush.
Clavaria cristate, Pers. Spruce swamp, O. A. C.

Polyporus heteroclytus, Fr. Dairy Bush, O. A. C.
Polyporus adustus (Willd), Fr. Stump on Quebec St., Guelph.
Polyporus dryadeus, Fr.
Polyporus chioneus, Fr. South of Dairy Bush, O. A. C.
Daedalia confragosa, Pers.
Lenzites sepiaria, Fr.
Marasmius oreades, Fr. Pasture near Dairy Bush, O. A. C.
Stereum Willeyi. Campus, O. A. C.
Stereum hirsutum (W.), Fr. Dry twigs, Dairy Bush.
Inocybe scaber, Mull.
Agaricus silvaticus, Schaeff. Spruce Woods, south of Dairy Bush, O. A. C.
Agaricus maritimus, Pk. Near Speed River, Guelph, agrees with Morgan's description of this species.
Fomes applanatus (Pers.), Fr. Very common.
Polyporus resinosus (Schad.), Fr. Common on beech logs.
Polyporus fumosus (Pers.), Fr.
Pholiota squarrosa, Mull. Old stump south of Dairy Bush, O. A. C.
Hydnum coralloides, Scop.
Panus stiptacus (Bull), Fr. Very common in old stumps.
Irpex sinuosus, Fr.
Hymenochaete rubigenosa (Schi.), Lev. Arbor vitae poles.
Psathyrella disseminate, Pers.
Pholiota unicolor, Vahl.
Tricholoma terreum, Schaeff.
Mycena galericulata, Scop.
Mycena prolifica, Sow.
Stereum zonatus, Berk.
Hirneola auricularia judae, Berk.
Tricholoma paneolum, Fr.
Tricholoma russula, Schaeff.
Clavaria formosa, Pers.
Fomes fomentarius (L.), Fr. Beech logs.
Collybia fusipes, Bull.
Trametis pini (Brot.), Fr.
Polyporus pubescens, Schw.
Gloeoporus conchoides, Mont.
Clitocybe candida, Bres.
Tremella lutescens, Pers.
Paxillus involutus (Batsch.) Fr.
Tremellodon gelatinosum, Pers.
Polyporus borealis (Wahlb.), Fr. Dairy Bush.
Pleurotus ostreatus, Jasq.
Tremella mesenterica, Retz.
Xylaria polymorpha, Grev.
Lactarius deliciosus (L.), Fr.
Polystictus pergamenus, Fr.
Stropharia stercoraria, Fr. Very common on cow dung in pastures.
Entoloma cookei, C. K. Rich. Very pretty specimen, with dark pink pileus with white ridges.
Daedalia quercina (L.), Pers.
Daedenia concentrica (Bolt.). Ces et De Not. *Corticium oakesii*, B. et C. *Ostrya virginiana* (Mill.), K. Kock.
Flamula squalida, Pk.
Pholiota marginata, Batsch.
Hypholoma sublateritium, Schaeff.
Galera flava, Pk. Campus, O. A. C.
Fomes ribes (Schum), Fr. On currant bushes.
Entomoloma rhodopolium, Fr. Campus, O. A. C.
Galera tenera, Schaeff. Campus, O. A. C.
Polyporus, gilvus, Schw.
Trametes rubescens, Fr.
Mycosphaerella pinodes (B. and Br.), R. E. Stone. Common on pea vines, following *Ascochyta pisi*.
Mycosphaerella lethalis, R. E. Stone. *Melilatus alba*, following *Ascochyta lethalis*, Ell and Barth.
Ascochyta lathyri, Berk. *Lathyrus silvestris*.
Panealus campanulatus, Linn.
Polyporus picipes, Fr.

Respectfully submitted,

J. E. HOWITT.

PART V.

THE PROFESSOR OF PHYSICS.

To the President of the Ontario Agricultural College:

SIR,—I have the honor to submit herewith my seventh report as head of the Department of Physics.

(*a*) LECTURE COURSES. In the first year the instruction in the Department consists of courses in Arithmetic, Elementary Drainage, Hydrostatics as a preparation for and followed by Soil Physics, and lastly, a course in the principles of Mechanics. The work of the second year consists of Surveying, Drainage and Farm Power. The third year makes a specialty of Meteorology, Cold Storage, and Ventilation, based upon a thorough course in Heat. In the final year Climatology, Advanced Drainage, and Advanced Soil Physics are emphasized.

(*b*) LABORATORY WORK. Laboratory practice is given in all the years in the various subjects.

WEATHER REPORT.

Tables I. and II. give a summary of the weather data at representative stations which this Department has equipped with the necessary meteorological instruments.

TABLE I.—WEATHER REPORT FOR 1912.

Month.	Mean temperature.	Departure from normal.	Highest temperature.	Lowest temperature.	Snowfall in inches.	Rainfall in inches.	Precipitation in inches.	Departure from normal.
O.A.C., Guelph—		(25 yrs)						25 (yrs)
January	9.2	—10.0	37.0	—16.0	15.0	1.30	2.80	+ .83
February	13.8	— 5.1	39.0	—21.0	8 0	0.00	.80	— .85
March	18.5	— 8.8	47.0	— 4.0	8.5	.50	1.35	+ .05
April	41.3	0.0	70.0	17 0	1.6	.98	1.14	— .56
May	51.7	— 1.7	76.0	30.0	.....	5.66	5.66	+3.14
June	62.4	— 1.2	85.0	35.0	.....	1.51	1.51	—1.15
July	67.1	— .9	88.5	44.0	.....	2.53	2.53	— .40
August	61.5	— 4.4	81.0	41.5	.....	6.07	6.07	+3.72
September	61.8	+ 2.8	84.0	33.0	.....	3.08	3.08	+ .79
October	51.5	4.4	75.0	29.0	.....	2.57	2.57	+ .25
November	38.5	+ 4.1	59.0	21.0	.....	1.58	1.58	— .66
December	29.7	+ 4.8	54.0	8.0	17.5	.49	2.24	+ .52
Year	42.3	—1.3	88.5	—21.0	50.6	26.27	31.33	+5.66

TABLE I.—Weather Report of 1912.—Continued.

Month.	Mean temperature.	Departure from normal.	Highest temperature.	Lowest temperature.	Snowfall.	Rainfall.	Precipitation in inches.	Departure from normal.
Cairo—		(1 year)						(1 year)
January	10.8	.....	41.0	—19.0	9.0	.40	1.30	.....
February	16.6	.....	42.0	—22.0	1.0	0.00	.10	.....
March	24.6	.....	50.0	0.0	.....	0.00	0.00	.....
April	43.7	.....	73.0	21.0	.....	6.72	6.72	.....
May	56.5	.....	84.0	33.0	.....	2.99	2.99	.....
June	62.3	.....	88.0	34.0	.....	2.41	2.41	.....
July	63.4	.....	90.0	46.0	.....	2.79	2.79	.....
August	66.3	.....	86.0	43.0	.....	8.16	8.16	.....
September	64.3	.....	92.0	43.0	.....	2.68	2.68	.....
October	50.9	.....	79.0	28.0	.....	2.10	2.10	.....
November	38.4	.....	67.0	17.0	.....	2.38	2.38	.....
December	29.6	.....	56.0	8.0	.....	.93	.93	.....
Year	43.9	.....	92.0	—22.0	10.0	31.56	32.56	.....
Charlottetown —		(6 years)						(6 years)
January	12.1	—5.2	43.0	—14.5	28.1	.47	3.28	— .13
February	19.2	+2.3	42.5	—16.0	50.0	.58	5.58	—3.18
March	25·3	— .2	48.5	— 9.2	24.1	1.15	3.56	+1.11
April	34.5	— .8	62.0	12.0	5.9	4.53	5.12	+2.06
May	47.1	+ .6	79.0	27.0	.....	4.38	4.38	+1.87
June	54.4	—2.2	84.5	41.0	.....	2.97	2.97	+ .47
July	65.2	+ .3	91.5	39.0	.....	6.92	6.92	+3.11
August	61.2	—1.8	81.0	42.0	.....	2.68	2.68	—1.79
September	53.6	—2.6	73.0	38.0	.....	2.90	2.90	— .82
October	46.9	+ .4	72.0	28.5	.....	3.72	3.72	+ .36
November	37.0	— .1	65.0	25.0	.....	3.05	3.05	—1.03
December	26.1	+ .2	50.0	— 2.0	10.5	5.40	6.45	+1.33
Year	40.2	— .8	91.5	—16.0	118.6	38.75	50.61	+9.72
Int'n'l. Farms, Forest—		(1 year)						(1 year)
January	6.7	.....	38.0	—20.0	7.5	.51	1.26	.....
February	12.6	.....	42.0	—26.0	6.5	0.00	.65	.....
March	18.3	.....	45.0	— 8.0	13.75	0.00	1.37	.....
April	43.4	.....	68.0	12.0	.....	2.45	2.45	.....
May	51.4	.....	78.0	30.0	.....	5.27	5.27	.....
June	58.6	.....	88.0	30.0	.....	.90	.90	.....
July	64.5	.....	90.0	40.0	.....	4.99	4.99	.....
August	66.2	.....	85.0	40.0	.....	4.24	4.24	.....
September	61.4	.....	89.0	31.0	.....	5.78	5.78	.....
October	49.5	.....	78.0	28.0	.....	2.13	2.13	.....
November	36.9	.....	62.0	12.0	.....	2.10	2.10	.....
December	27.0	.....	54.0	4.0	4.5	.86	1.31	.....
Year	41.4	.....	90.0	—26.0	32.25	29.23	32.45	.....

TABLE I.—WEATHER REPORT OF 1912.—Continued.

Month.	Mean temperature.	Departure from normal.	Highest temperature.	Lowest Temperature.	Snowfall in inches.	Rainfall in inches.	Precipitation in inches.	Departure from normal.
Lakeside Fruit Farms—		(1 year)						(1 year)
January	11.2	.....	37.0	—11.0	.....	.37	.37	.....
February	17.2	.....	41.0	—13.0	.....	0.00	0.00	.....
March	23.3	.....	49.0	— 2.0	.....	.21	.21	.....
April	42.7	.....	72.0	19.0	.....	2.18	2.18	.....
May	52.7	.....	80.0	31.0	.....	5.12	5.12	.....
June	61.5	.....	83.0	37.0	.....	1.33	1.33	.....
July	68.5	.....	90.0	45.0	.....	3.74	3.74	.....
August	64.2	.....	87.0	42.0	.....	2.88	2.88	.....
September	63.4	.....	90.0	38.0	.....	4.61	4.61	.....
October	50.7	.....	78.0	32.0	.....	1.75	1.75	.....
November	39.9	.....	62.0	21.0	.....	2.65	2.65	.....
December	30.5	.....	56.0	12.0	.....	.97	.97	.....
Year	43.8	.....	90.0	—13.0	.....	25.81	25.81	.....
Leamington—		(6 years)						(6 years)
January	10.3	—12.3	36.0	— 9.5	4.5	.55	1.00	—1.50
February	18.8	— 3.6	43.0	—20.5	0.0	0.00	0.00	— .94
March	27.4	— 7.0	71.0	0.0	9.0	2.40	3.30	+1.64
April	43.9	— .3	69.0	10.0	.....	2.19	2.19	+ .12
May	61.1	+ 5.8	81.0	32.0	.....	2.75	2.75	+ .79
June	63.5	— 2.0	87.0	41.0	.....	2.79	2.79	— .11
July	70.6	— 1.3	92.0	40.0	.....	5.01	5.01	+2.89
August	67.5	— 1.9	88.0	46.0	.....	2.02	2.02	— .67
September	62.2	0.0	.....	.....	.....	2.11	2.11	— .67
October	50.2	0.0	.....	.....	.....	2.44	2.44	0.00
November	37.6	0.0	.....	.....	.....	2.69	2.69	0.00
December	30.4	+ 1.6	55.0	9.0	3.0	.75	I.05	— .65
Year	45.3	— 1.8	92.0	—20.5	16.5	25.70	27.35	+ .90
Maitland—		(7 years)						(7 years)
January	7.0	—11.2	40.0	—27.0	12.00	.30	1.50	— .49
February	11.8	— 1.1	41.0	—21.0	17.40	.....	1.74	+ .05
March	13.4	—10.6	41.0	—13.0	.....	.....	.....	—1.40
April	41.6	+ 1.8	65.0	4.0	3.00	1.99	2.29	+ .34
May	49.4	— 3.2	77.0	34.0	.....	2.77	2.77	— .30
June	58.8	— 1.6	81.0	36.0	.....	1.89	1.89	— .44
July	67.0	— 1.1	90.0	46.0	.....	1.99	1.99	— .25
August	62.5	— 4.3	82.0	42.0	.....	2.17	2.17	+ .25
September	60.7	+ .2	81.0	38.0	.....	4.08	4.08	+1.21
October	45.6	— 3.6	74.0	24.0	.....	.60	.60	—1.36
November	40.9	+ 5.2	63.0	11.0	.80	3.03	3.11	+1.09
December	29.7	+ 7.8	57.0	0.0	5.00	.72	1.22	— .86
Year	40.7	— 1.8	90.0	—27.0	38.20	19.54	23.36	—2.16

TABLE I.—WEATHER REPORT FOR 1912.—Continued.

Month.	Mean temperature.	Departure from normal.	Highest temperature.	Lowest temperature.	Snowfall in inches.	Rainfall in inches.	Precipitation in inches.	Departure from normal.
Magnetawan—		(7 years)						(7 years)
January	5.0	—7.7	32.0	—44.0	42.60	.....	4.26	+1.02
February	12.6	+1.7	44.0	—34.0	21.30	.14	2.27	— .33
March	15.9	—4.9	44.5	—28.5	7.20	.11	.83	—1.55
April	34.9	—1.4	66.5	— 4.5	1.10	2.44	2.55	— .11
May	51.4	+2.2	77.0	25.0	.....	5.59	5.59	+2.36
June	54.8	—4.6	80.0	31.5	.....	1.98	1.98	— .32
July	64.8	+ .1	88.5	37.5	.....	1.19	1.19	— .67
August	58.1	—4.0	79.5	29.0	.....	3.91	3.91	+ .07
September	57.0	+1.1	82.5	29.5	.....	3.22	3.22	+ .22
October	44.7	+1.3	74.5	21.0	8.00	3.93	4.73	+1.01
November	31.1	+ .6	60.0	1.0	1.35	3.03	3.16	— .16
December	21.8	+4.8	53.0	—13.0	3.02	1.51	1.81	— .75
Year	37.7	— .9	88.5	—44.0	84.57	27.05	35.50	+.79
Monteith—		(2 years)						(2 years)
January	—15.5	—14.1	17.0	—46.0	6.50	.....	.65	—1.05
February	3.9	— 3.3	36.0	—33.0	9.50	.....	.95	— .60
March	9.7	— 2.9	40.0	—32.0	3.50	.....	.35	— .20
April	25.5	— 1.9	69.0	—18.0	5.50	1.13	1.68	+ .42
May	46.1	— 4.4	81.0	19.0	1.20	5.47	5.59	+2.64
June	52.8	— 5.7	90.0	19.0	.....	4.18	4.18	+ .47
July	59.9	— 4.6	95.0	30.0	.....	3.50	3.50	+ .35
August	54.1	— 5.6	80.0	27.0	.....	3.45	3.45	+ .69
September	51.6	+ 1.3	79.0	22.0	.....	4.05	4.05	+ .90
October	39.0	— .5	81.0	8.0	.75	1.55	1.62	— .09
November	25.0	+ 3.0	43.0	2.0	.60	.....	.06	—1.87
December	13.6	— 2.2	42.0	—18.0	13.00	.25	1.55	—1.61
Year	30.5	— 3.4	95.0	—46.0	40.55	23.58	27.63	+ .04
Powle's Corners—		(5 years)						(5 years)
January	8.6	—8.0	36.0	—27.0	1.00	.....	.10	—1.12
February	13.4	—3.4	38.0	—30.0	.80	.....	.08	—1.22
March	20.3	—5.5	46.0	—10.0	1.20	.....	.12	— .27
April	37.6	—1.9	66.0	9.0	.....	.20	.20	—2.13
May	54.6	+ .4	80.0	29.0	.....	8.47	8.47	+4.73
June	59.5	—3.6	82.0	36.0	.....	.50	.50	— .67
July	66.6	—2.4	88.0	47.0	.....	7.03	7.03	+2.62
August	61.1	—4.0	80.0	39.0	.....	4.42	4.42	+1.50
September	59.1	+ .2	86.0	34.0	.....	2.66	2.66	+ .09
October	47.2	+2.2	74.0	27.0	.....	2.80	2.80	— .16
November	35.0	+2.0	56.0	16.0	.....	3.78	3.78	+1.44
December	26.5	+4.3	54.0	0.0	10.0	.....	1.00	— .05
Year	40.8	—1.6	88.0	—30.0	13.00	29.86	31.16	+4.76

TABLE I.—Weather Report for 1912.—Continued.

Month.	Mean temperature.	Departure from normal.	Highest temperature.	Lowest temperature.	Snowfall, in inches.	Rainfall, in inches.	Precipitation in inches.	Departure from normal.
Richards Landing—		(7 years)						(7 years)
January	—1.0	—16.3	25.0	—30.0	25.0	0.0	2.50	+ .59
February	11.6	—4.5	35.0	—35.0	6.0	0.0	.60	—1.29
March	14.9	—7.9	48.0	—18.0	3.0	0.0	.30	—1.58
April	36.0	— .9	62.0	0.0	.....	2.30	2.30	— .06
May	53.5	+3.6	77.0	30.0	.....	3.83	3.83	— .08
June	57.8	—2.9	85.0	34.0	.....	1.25	1.25	—1.14
July	63.9	— .9	92.0	40.0	.....	1.25	1.25	—1.52
August	59.3	—3.4	78.0	38.0	.....	4.12	4.12	+ .55
September	59.1	+ .8	85.0	30.0	.....	5.23	5.23	+1.31
October	47.5	+2.4	75.0	27.0	.....	2.65	2.65	— .24
November	32.9	+ .2	54.0	8.0	.6	.15	.21	—2.23
December	23.5	+2.4	48.0	—13.0	11.0	1.07	2.17	—1.64
Year	38.3	—2.3	92.0	—35.0	45.6	21.85	26.41	—7.33
Vineland Station—		(4 years)						(4 years)
January	14.7	—9.3	44.0	— 7.0	.....	.06	.06	—1.67
February	19.1	—5.2	46.0	—12.0	.....	0.00	0.00	— .68
March	26.6	—4.6	50.0	2.0	.....	0.00	0.00	— .66
April	42.7	+ .2	82.0	23.0	.....	.55	.55	—1.82
May	53.3	+1.1	83.0	33.0	.....	3.38	3.38	+ .53
June	59.7	—3.1	81.0	38.0	.....	.31	.31	—1.54
July	69.2	0.0	.....	.....	.....	3.34	3.34	0.00
August	68.0	+ .5	.....	.....	.....	3.45	3.45	0.00
September	63.5	+2.1	92.0	37.0	.....	2.19	2.19	— .48
October	52.8	+4.8	71.0	31.0	.....	2.10	2.10	— .47
November	42.2	+3.0	63.0	22.0	3.80	2.12	2.50	+ .65
December	33.6	+3.8	57.0	12.0	.33	1.33	1.36	+ .13
Year	45.4	— .6	92.0	—12.0	4.13	18.83	19.24	—6.01
Walkerton—		(4 years)						(4 years)
January	8.9	—9.2	35.0	—18.0	.....	.....	.....	.....
February	17.8	—1.1	45.0	—28.0	.....	.....	.....	.....
March	18.9	—8.3	45.0	—12.0	.....	.....	.....	.....
April	42.5	— .9	61.0	11.0	.....	.....	.....	.....
May	55.1	0.0	81.0	23.0	.....	5.03	.....	.....
June	61.3	—1.4	86.0	35.0	.....	1.58	.....	.....
July	62.1	—5.5	90.5	45.0	.....	2.18	.....	.....
August	60.1	—4.5	84.0	38.0	.....	7.82	.....	.....
September	61.1	+3.4	87.0	36.0	.....	5.37	.....	.....
October	49.1	+1.8	76.0	31.0	.....	4.60	.....	.....
November	37.3	+5.1	59.0	14.0	.....	4.38	.....	.....
December	27.8	+2.3	55.0	3.0	.....	1.71	.....	.....
Year	41.8	—1.5	90.5	—28.0	.....	32.67	.....	.....

TABLE I.—Weather Report for 1912.—Continued.

Month.	Mean temperature.	Departure from normal.	Highest temperature.	Lowest temperature.	Snowfall in inches.	Rainfall in inches.	Precipitation in inches.	Departure from normal.
Wyoming—		(1 year)						(1 year)
January	9.2	.....	36.0	—16.0	.....	.....	.....	.....
February	14.9	.....	41.0	—22.0	.....	.....	.....	.....
March	22.6	.....	46.0	— 4.0	.....	.....	.....	.....
April	43.3	.....	72.0	18.0	.....	2.77	2.77	.....
May	55.2	.....	82.0	32.0	.....	5.65	5.65	.....
June	61.8	.....	93.0	34.0	.....	1.66	1.66	.....
July	61.7	.....	91.0	45.0	.....	4.58	4.58	.....
August	61.0	.....	87.0	41.0	.....	5.57	5.57	.....
September	61.9	.....	91.0	35.0	.....	5.64	5.64	.....
October	49.6	.....	81.0	27.0	.....	2.74	2.74	.....
November	40.3	.....	68.0	17.0	.....	2.99	2.99	.....
December	30.8	.....	56.0	7.0	.....	1.17	1.17	.....
Year	42.7	.....	93.0	—22.0	.....	32.77	32.77	.....

TABLE. II.—Length of Seasons at Various Stations, 1912.

Stations.	Last killing frost in spring.		First killing frost in autumn.		No. of days between first and last frosts.	Average length of season free from killing frosts.
	Date.	Degree.	Date.	Degree.		
Guelph	May 14...	30.0	Oct. 16...	29.0	155	148 (25 years)
Charlottetown	May 23...	27.5	Oct. 17...	28.5	147	153 (6 years)
Cairo	Apr. 28...	28.0	Oct. 16...	28.0	171	171 (1 year)
Int. Farms, Forest	June 8...	30.0	Oct. 16...	28.0	130	130 (1 year)
Lakeside Farms, Forest.	Apr. 28...	27.0	Nov. 3...	30.0	189	189 (1 year)
Vineland Station	Apr. 20...	30.0	Nov. 23...	29.0	217	217 (1 year)
Leamington	Apr. 28...	28.0	.....	.....	.....	157 (4 years)
Magnetawan	May 15...	25.5	Aug. 30...	29.0	107	125 (7 years)
Maitland	Apr. 28...	27.0	Oct. 9.	30.0	164	147 (7 years)
Richards Landing	May 15...	30.0	Sep. 28...	30.0	136	134 (7 years)
Monteith	July 27...	30.0	Aug. 17...	29.0	21	74 (2 years)
Powle's Corners	May 14...	29.0	Oct. 16...	27.0	155	158 (5 years)
Walkerton	May 14...	26.0	Nov. 3...	24.0	173	153 (5 years)
Wyoming	Apr. 28...	26.0	Oct. 16...	27.0	171	171 (1 year)

TABLE III.—WIND RECORD AT GUELPH, 1912.

Month.	Miles of wind.	No. of days on which records were kept.	Average miles of wind per day.	Average miles of wind per hour.	Windiest day.				Calmest day.			
					Total miles.	Miles per hour	Miles on windiest hour.	Least windy hour.	Total miles.	Miles per hour	Windiest hour.	Calmest hour.
January	7,497	27.3	274.615	11.4	693	28.9	35	22	28	1.2	9	0
February	6,264	25.1	249.562	10.4	643	26.8	43	24	12	.5	4	0
March	5,431	26.0	208.885	8.7	435	18.1	28	8	52	2.2	9	0
April	10,435	30.0	347.833	14.5	620	25.8	36	17	79	3.3	9	0
May	7,897	30.1	262.358	10.9	488	20.3	34	15	101	4.2	11	0
June	5,320	29.9	177.926	7.4	411	17.1	28	4	3	.1	3	0
July	4,593	27.1	169.483	7.1	266	11.1	15	4	37	1.5	8	0
August	5,266	31.0	169.871	7.1	332	13.8	16	0	10	.4	3	0
September	4,692	30.0	156.400	6.5	432	18.0	18	2	13	.5	5	0
October	6,026	26.0	231.769	9.7	469	19.6	22	5	36	1.5	6	0
November	*											
December	*											
Ten months. 1912	63,421	282.5	224.499	9.4	693	28.9	43	22	3	.1	3	0
Year 1911	96,632	357.7	270.1	11.3	769	32.0	40	11	37	1.5	7	0
November, 1911	10,914	30.0	363.8	15.1	748	31.2	39	24	107	4.4	11	0
December, 1911	9,357	30.2	309.8	12.9	769	32.0	40	11	114	4.8	12	0

* Instrument out of order and being repaired.

DRAINAGE SURVEYING.

During 1912 the Drainage Campaign has been continued. Table IV. presents a summary of the work done since the Campaign was inaugurated.

TABLE IV.—SUMMARY OF SURVEY WORK OF THE DEPARTMENT OF PHYSICS.

Year.	Applications.	Surveys.	Applications held over.	Acres surveyed.	Miles of drain.	Demonstrations.	
						No.	Average Attendance.
1906	15	15	.....	500	45	.....	.....
1907	126	70	56	3,500	350	.....	.....
1908	166	100	66	5,000	510	43	.....
1909	302	179	121	5,157	613	48	18.0
1910	518	383	135	14,672	1,800	132	23.6
1911	414	327	87	15,211	1,864	142	17.4
1912	430	293	137	17,212	2,278	70	21.7
Totals	.....	1,367	.....	61,252	7,460	435	.....

It will be observed that the area surveyed was 2,000 acres in excess of that for 1911, although the number of surveys was somewhat less. This is a repetition of what occurred last year, and indicates still further that drainage is being done in much larger blocks from year to year. The number of demonstrations is only about half that for 1911, although the attendance was considerably larger. The reduction in number is due to the fact that more of our surveys were made close together this year, and, hence, one demonstration served a larger number of surveys than last year.

The drainage survey appropriation was again $4,000, but a grant of $5,000 was set aside from the Federal Subsidy for the extension of the drainage work. Some surveys were made on this fund.

Drainage Surveys by the District Representatives.

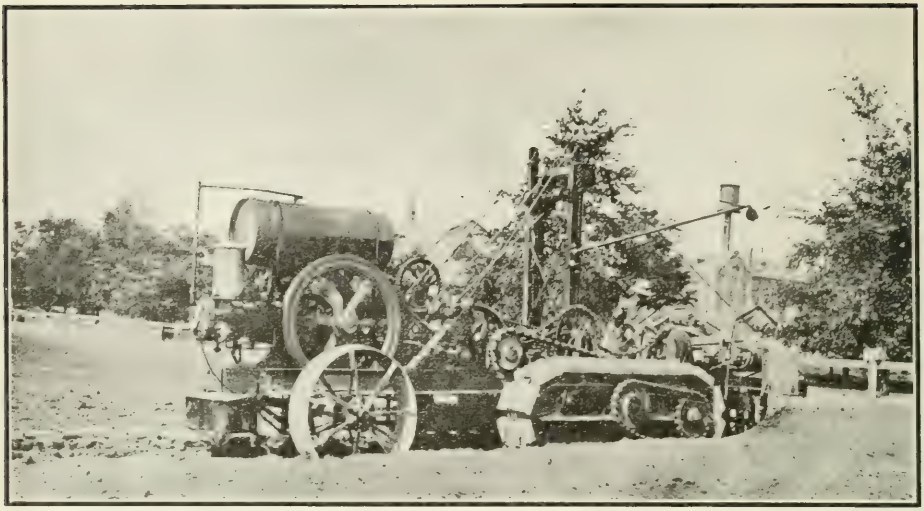
When the drainage survey work began in 1905 and 1906 all the work was done by the department of Physics. A year or two later when the District Representatives began to be appointed some of them took over the drainage work for their counties, others, however, found that through pressure on their time they were unable to do so, and, hence, asked that the survey work in their counties be done by this department in co-operation with them. This arrangement has been made at one time or another in the following counties: Durham and Northumberland, Hastings, Norfolk, Lambton, Essex, Simcoe. When an urgent application

Fig. 1.—A Practical Drainage Demonstration.

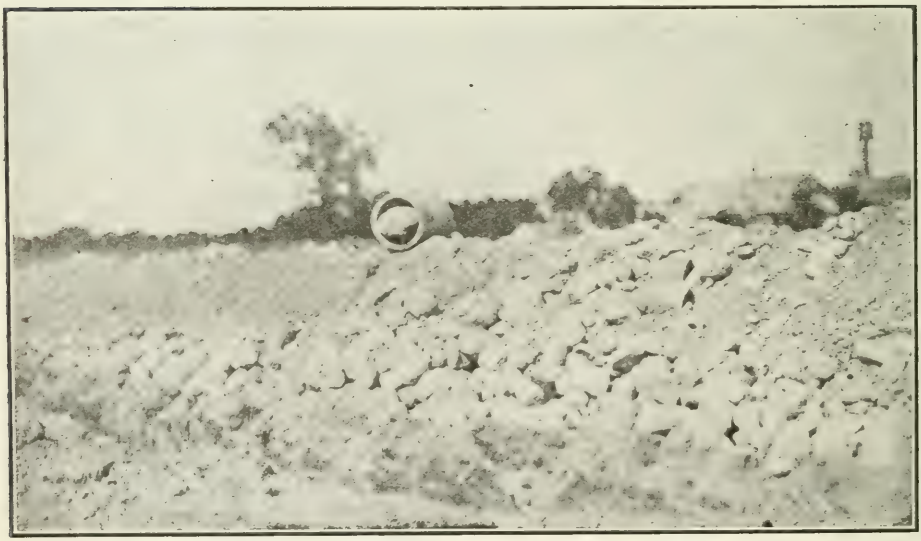
has been received, to which the department was unable to respond at once, the representatives there have made the necessary surveys. By reports from the District Representatives we learn that the amount of work done by them has been quite extensive. Altogether during 1912 they have made 293 surveys covering 6,640 acres. Where the representatives and this department have co-operated good results have been obtained, as they, being on the ground, were able to select the locations for the demonstrations from personal knowledge and look after the advertising, and thus secured a little larger attendance, while we, with our fieldmen and draftsmen, were able to make the surveys and draft the plans.

A New Feature in the Drainage Campaign.

In our drainage survey campaign since its inception we have been able to survey over 61,000 acres, and actual drainage operations have received such an impetus that the amount of drainage being done now is between two and three times as great as in 1905; still, despite this increase, there are quite a number of localities (townships and counties) where practically no drainage has been done. The reasons for this we need not stop to analyze. However, by the aid of the



The College Ditcher. Note the water-tank for cooling engine. This is the best cooling system for these machines.



Showing a "nest" of stones through which the College Ditcher dug without stopping. The tile is 8 inches inside diameter. The machine is specially equipped for stony lands.

grant from the Federal Subsidy, already mentioned, we have been able to devise a plan which, I believe, is destined to reach every such locality, namely, to select a plot needing drainage and actually put in the drains in half of it, leaving the other half undrained for comparison. One of these demonstrations has already been held on Mr. Neil McDougald's farm near Tara, Bruce County. Fig. 1 shows the number present at 3 o'clock in the afternoon on October 11th. when the drains were being put in, although throughout the entire day spectators came and went. In all about two-hundred-and-fifty witnessed the demonstration. Next year when the crops are growing on the drained and undrained parts a drainage picnic will be held in the grove which lies just beside the field. This demonstration took rise in a drainage picnic which was held under the auspices of the Farmers Club of Hall's Corners, just north of Tara, the object being to create an interest in the subject, for very little if any drainage had ever been done there.

Several drainage plots have already been selected in Haldimand County for next year. Others will be chosen in Eastern Ontario, for there drainage has made least advances. The conditions on which these practical drainage demonstrations are undertaken are as follows:

1. The plots must be situated in a locality (township) where little or no drainage has been done. This campaign is intended to reach districts not reached by the survey campaign.

2. A field of from 10 to 12 acres is required. It must lie along a main road, and slope toward the road, so that passers-by may observe results. There must be a good outlet reasonably convenient to the field.

3. The department of Physics will make the survey, prepare the plans, dig the drains and lay the tile, hold a public drainage demonstration while the drains are being put in, also another the following year when the crops are growing to observe and discuss results.

4. The owner will provide the tile, haul and distribute them, fill the ditch and board the men while the machine is doing the work. He must also agree to leave the other half of the field undrained for three crops, sow both halves to the same crop each year, harvest and thresh the two parts separately, and report promptly to the department the yields from the drained and undrained parts.

New Traction Ditcher.

A traction ditcher was purchased by the Departments of Field Husbandry, Animal Husbandry, Horticulture, and Physics, the first three with a view to having some drainage done on portions of the College farm under their charge, and the department of Physics with a view to using it in the drainage demonstrations already described.

INVESTIGATIONS.

Solubility of Cement Tile.

In 1910 we reported some investigations as to the solubility of cement tile, two kinds of tests being made: 1st, Small pieces of tile in distilled water and in well water. 2nd, Three half tile in running well water. The conclusion reached then was that the tests with small pieces were under such artificial conditions that

they were practically useless, but that those with half tile were probably close to field conditions, and should be continued. This was done and we are now in a position to report further.

Two of the half tile, samples No. 1 and No. 2 were made by the "dry process," and hence are quite porous. Both of these showed considerable gain in weight for some time, but for the last year of the test were practically constant in weight. No. 3 was made by the "wet process," and is almost impervious to water. This one has lost weight on all tests but one. It might have been expected that if any difference the porous ones would loose more in weight than the impervious. The following details will show what occurred in each case.

SAMPLE No. 1.—A half tile, proportions 6 to 1, made on London two piece machine, dry process, May, 1908, watered for a week, stored in cellar. Dry weight, 1797.15 grams.

Dates.	Dry Weight (Grams).	Months in Solution.	Loss (Grams).	Gain (Grams).
May 6, 1909	1,797.15	.....	.....	.....
December 18, 1909	1,803.50	7½	.....	6.0
March 24, 1910	1,803.90	3	.....	.4
November 23, 1910	1,804.30	8	.....	.5
January 3, 1911	1,804.71	1½	.....	.41
March 25, 1911	1,804.30	2½	.41	.....
Net gain	.....	.....	.....	6.80

In the last 12 months, gain ..... .50 grams.
In the last 4 months, gains equal losses.

SAMPLE No. 1.—A half tile, proportions 6 to 1, made on London two piece machine, dry process, but considerably wetter than No. 1, May, 1908. Watered for a week, stored in cellar. Dry weight, 1910.25 grams.

Dates.	Dry Weight (Grams).	Months in Solution.	Loss (Grams).	Gain (Grams).
May 6, 1909	1,910.25	.....	.....	.....
December 18, 1909	1,910.25	7½	.....	.....
March 24, 1910	1,914.30	3	.....	4.05
November 23, 1910	1,914.05	8	.25	.....
January 3, 1911	1,914.12	1½	.....	.07
March 25, 1911	1,914.09	2½	.03	.....
Net gain	.....	.....	.....	3.84

In the last 12 months, loss ..... .15 grams.
In the last 4 months, gain ..... .04 ,,

SAMPLE No. 3.—A half tile, proportions 6 to 1, made on the London two piece tile machine, wet process, so wet tile would not hold shape and mould would not clean. Allowed to dry, getting a few showers of rain, and then stored in cellar. Dry weight, 2001.0 grams.

Dates.	Weights (Grams).	Months in Solution.	Loss (Grams).	Gain (Grams).
May 6, 1909	2,001.00			
December 18, 1909	1,999.10	7½	1.90	
March 24, 1910	1,996.40	3	2.70	
November 23, 1910	1,994.70	8	1.70	
January 3, 1911	1,995.00	1½		.30
March 25, 1911	1,994.30	2¾	.70	
Net loss			6.30	

In the last 12 months loss ..... 2.10 grams.
In the last 4 months, loss ..... .40 ,,

From the behavior of these three samples we have been driven to the conclusion that in ordinary soil water there is no danger of good cement tile dissolving and crumbling, and consequently that cement tile properly made and properly cured must prove durable for drainage purposes. By "properly made" we mean of a strength not weaker than 4 to 1, good cement, thoroughly mixed, made as wet as the machine will work, and firmly packed. By "properly cured" we mean not allowed to dry out rapidly during initial set, kept moist for a week and then subjected to weather conditions until the tile are strong enough to haul without serious breakage. Steam curing is even better.

The gain in weight of the porous tile is probably explained by the fact that the water contains some lime, and that this entering the pores reacts with the cement or is mechanically deposited throughout the body of the tile.

Making Cement Tile.

During June and July we made by hand some 5,000 three-inch and 1,000 four-inch cement tile on the Farmers' Cement Tile Machine, and 1,000 four-inch on the Sureshut machine, mortar mixed 1 to 4. The latter does not in our opinion pack the cement firm enough to make good tile. On the "Farmers" a bag of cement mixed 1 to 4 makes 57 four-inch tile, but on the "Sureshut" one bag mixed in the same proportions makes 69 four-inch tile.

In the three-inch tile the "Farmers" machine makes 77 tile from a bag of cement.

The material required for 1,000 tile is as follows:

3-inch Tile, "Farmers" machine—
Cement for 1,000 tile: 13 bags, or 3¼ barrels.
Sand for 1,000 tile: 52 cubic feet, or 2 yards, nearly.

4-inch Tile, "Farmers" machine—
Cement for 1,000 tile: 16 bags, or 4 barrels.
Sand for 1,000 tile: 64 cubic feet, or 2 1-3 yards, nearly.

4-inch Tile, Sureshut machine—
Cement for 1,000 tile: 14.64 bags, or 3 9-10 barrels.
Sand for 1,000 tile: 58.5 cubic feet, or 2 1-6 yards.

The speed of making was not as great as we had expected. Including the time necessary to screen sand, keep tile watered for a week after being made, and stack the tile outside two men were hardly able to average 350 tile for a day's work.

PROTECTION AGAINST LIGHTNING.

From 1901 to 1910, inclusive, reports of damage done by lightning were collected by this department. In all 599 reports were received, including barns, houses and other buildings. Of these buildings 317, a shade over half, were totally destroyed by fire. Approximately one building was burned in every two struck. Of the barns three were burned out of every four struck. Many of our reports were obtained first from the newspapers, followed by correspondence to obtain personal reports of the owners. The newspapers naturally contain reports of only the worst cases, so that taking the country as a whole the proportion of buildings totally destroyed is not as high as that mentioned above. Of the rodded buildings, however, only one was burned out of every six struck. Hence of the rodded buildings struck, the rods saved the difference between one-half and one-sixth which is one-third or 33⅓ per cent., while of the rodded barns struck the saving due to the rods was the difference between three-quarters and one-sixth which is seven-twelfths or 58⅓ per cent. As the reports from year to year continued to maintain approximately these percentages there seemed to be no particular object in continuing the reports along the same lines as heretofore, and so they were dropped.

Valuable as the above results were they failed to reach what, it seems to me, will yet prove the most vital point of the lightning rod question. Our reports dealt only with saving a building when it is struck. But science indicates that lightning rods have another, and possibly a more important function, viz., preventing strokes from occurring. This phase I have had in mind for years, and have frequently stated my implicit belief in the teachings of science on this point, but I am sorry to say, my farmer friends have looked upon it as "another pretty theory got up by you scientific(?) fellows." I knew that facts alone would carry conviction, and for years I have been seeking practical information to prove—or disprove—the claims of science. Several possible channels were explored, only to prove barren, but at last we have found one that gives good promise of valuable results.

During 1911 all the fire insurance companies doing business in Ontario were communicated with. In February, 1912, an address by the writer on "The Principles of Lightning and of Lightning Rods" was delivered in Toronto before the Association of Mutual Fire Underwriters, and in November another before Insurance Institute, also in Toronto. As a result of the correspondence and addresses the attention of the insurance companies has been drawn to our efforts and their assistance enlisted, and after some groping on our part as to the form in which information can be most readily supplied by them, reports are just beginning to reach us in a valuable form.

The Sydenham Mutual Fire Insurance Co. of Owen Sound, which allows a reduced rate on rodded buildings, reports as follows:

RISKS.

Policies written in 1912 (80 per cent. of these cover both a barn and a house. Of the remainder about half are barns and half houses)		2,310
Total number of barn risks written		2,079
Total number of house risks written		2,079
House only rodded	19	
Barn and outbuildings only rodded	242	
Barn and house both rodded	176	

Total number of rodded barns 418
Total number of rodded houses 195

$$\text{Per cent. of barns rodded} = \frac{418}{2079} \times 100 = 20.6\%.$$

$$\text{Per cent. of houses rodded} = \frac{195}{2079} \times 100 = 9.3\%.$$

LIGHTNING LOSSES PAID IN 1912.

21 claims paid on barns struck by lightning.
6 barns were burned, loss $5,103 50
15 barns were damaged, loss 124 26
Rodded barns among these, none.
12 claims were paid on houses struck by lightning.
Damages to the twelve $191 53
Rodded houses, none.

The figures regarding risks give us an idea of approximately the percentage of rodded buildings among the risks carried by the Sydenham.

Since about 20½ per cent. of their barns and 9⅓ per cent. of their houses are rodded we should have expected that 20½ per cent. of the barn claims would be on rodded barns and 9⅓ per cent. of the house claims would be on rodded houses. But not a rodded building was struck, or if struck, not one was damaged. Is this a mere accident? It is only one report of one company for one year, but the result is just what science leads us to expect. Science indicates that lightning rods perform two functions: first the prevention of strokes; secondly, carrying off of strokes that do occur.

Regarding the latter, the statistics given above show that rods do actually carry off strokes, thus preventing damage. The report of the Sydenham Mutual is the first direct practical complete information I have ever seen bearing on the *prevention* of strokes. The Sydenham report is very valuable, but the summary of similar reports from thirty or forty companies would be much more so, and we hope to be able to present such a report a year hence.

BULLETINS.

During the year two bulletins on Cold Storage were prepared by Mr. Graham, entitled "Cold Storage on the Farm, Its Value, and How to Provide for it," and "Mechanical Systems of Refrigeration, Pre-cooling, Insulation." A Bulletin on protection of buildings against lightning has been partly prepared.

CORRESPONDENCE.

The correspondence of the department has increased very materially. During the year 4,377 letters were written. This together with post cards, bills, lecture notes, directions for practical work, bulletins, weather records, etc. has made it necessary to engage an extra stenographer throughout a greater portion of the year.

All of which is respectfully submitted.

WM. H. DAY.

PART VI.

PROFESSOR OF CHEMISTRY.

To the President of the Ontario Agricultural College:

SIR,—I have the honor to present the following report of the Department of Chemistry.

The course of instruction laid down in the College Calendar has been faithfully carried out, and, as no changes have been made this year, it is not necessary to repeat the details here. We have made some changes in the method of carrying out the laboratory work which afford us a better opportunity of keeping track of the individual student work, and at the same time more thorough instruction is given. This, however, entails a greater amount of labor on our part, but we think it time well spent.

In addition to the instruction of the regular courses, we have given the usual lectures and practical work to the students of the various short courses.

Outside of the laboratory about the usual amount of instruction has been given by way of correspondence, articles for agricultural and technical papers, and by addressing meetings of various kinds. We are glad to make use of all these means of spreading the information gathered from our investigation work.

EXAMINATION OF MISCELLANEOUS SAMPLES.

We have, as usual, received a larger number of samples of a great variety of materials for analysis. Some of the analytical work asked for was of a purely commercial nature and clearly work we should not be called upon to do. All such correspondents were referred to commercial chemists in Toronto, Hamilton and Montreal. There were, however, nearly two hundred samples of materials either fully or partly analysed and reports made thereon. These samples may be classified as follows:

Soils	49	Insecticides and Fungicides	12
Fertilizers	29	Miscellaneous	39
Cattle Feeds	28		
Human Foods	10	Total	194
Water	27		

INVESTIGATION WORK.

WHEAT AND FLOUR. We have not been called upon to test so many samples of wheat and flour this year as last. This is partly due to the fact that some of our largest customers have so fully realized the value of the work that they have installed flour testing plants of their own, and, partly also, to the fact that a good baking flour, like that produced from last year's crop, requires little testing.

Up to date we have not been able to procure a full set of samples of the different grades of wheat as shipped out of the Western Provinces this year, but what little we have been able to mill shows excellent milling and baking properties.

During the summer we have been able to continue our work on the milling and baking value of sprouted wheat. We were also able to make a further study of the influence of different kinds of malt on the quantity and quality of bread, and some very interesting and instructive information was obtained by repeating some of Wood's work on the influence of acids and salts on the quality of gluten. None of this work is sufficiently advanced to warrant us in publishing results, but we hope to continue the work this coming season.

The results of the baking tests of the spring wheats grown on the experimental plots in 1911 could not be given last year as the work was not completed in time. These results appear below, and, for the sake of comparison, those of 1910 were also included.

TABLE SHOWING RESULTS OF BAKING TESTS WITH ONTARIO SPRING WHEATS.

Name of Variety.	Crop.	Wet Gluten.	Absorption.	Yield.	Volume.	Quality of Bread.			Protein in Flour.
						Color.	Texture.	Appearance.	
		%	%	Grms.	c.c.	%	%	%	%
Standard	1910	39.60	60.6	497	2,460	100.0	100.0	100.0	.....
	1911	36.53	60.0	481	2,460	100.0	100.0	100.0	11.6
Early Java	1910	38.67	54.7	469	2,300	98.0	92.0	95.0	.....
	1911	57.90	57.6	484	2,260	.....	.....	90.0	.....
Herison (Bearded)	1910	33.50	51.8	470	2,210	98.0	90.0	92.0	.....
	1911	55.73	57.6	498	2,080	96.0	75.0	95.0	13.72
Pringle's Champion	1910	34.10	52.9	474	1,950	90.0	.....	80.0	.....
	1911	55.67	57.6	494	1,860	95.0	.....	85.0	13.97
Red Fern	1910	33.10	54.7	481	1,950	90.0	.....	80.0	.....
	1911	61.70	57.6	495	1,900	95.0	.....	85.0	14.92
Read's Reliable	1910	35.43	51.8	474	2,150	98.0	98.0	95.0	.....
	1911	47.40	57.6	502	1,990	95.0	95.0	98.0	13.60
Carleton	1910	36.17	63.5	477	2,030	90.0	.....	80.0	.....
	1911	54.50	57.6	502	1,880	95.0	.....	85.0	14.92
Climax	1910	33.93	51.8	469	2,070	91.0	.....	80.0	.....
	1911	49.70	58.8	493	2,110	.....	.....	85.0	17.7
Chappel	1910	35.53	53.5	477	2,110	91.0	.....	80.0	.....
	1911	46.77	58.2	481	2,130	.....	.....	85.0	12.92
White Russian	1910	34.53	54.7	491	2,130	100.0	95.0	90.0	.....
	1911	54.57	59.4	498	2,440	100.0	100.0	102.0	13.0
Preston	1910	34.17	54.7	479	2,100	90.0	80.0	90.0	.....
	1911	58.17	61.7	501	2,290	.....	.....	85.0	16.75
Minnesota 163	1910	33.37	54.7	479	2,240	100.0	92.0	96.0	.....
	1911	52.60	58.8	491	2,350	96.0	93.0	101.0	13.56
Queensland	1910	31.73	60.6	495	2,410	100.0	100.0	100.0	.....
	1911	58.77	60.0	509	2,040	94.0	75.0	95.0	15.55

TABLE SHOWING RESULTS OF BAKING TESTS WITH ONTARIO SPRING WHEATS.—Con.

Name of Variety.	Crop.	Wet Gluten.	Absorption.	Yield.	Volume.	Quality of bread.			Protein in flour.
						Color.	Texture	Appearance.	
		%	%	Grms.	c.c.	%	%	%	%
Hungarian	1910	33.60	54.7	473	2,440	103.0	95.0	95.0	.....
	1911	58.40	59.4	495	2,450	100.0	99.0	100.0	15.8
Gatineau	1910	38.67	61.2	477	2,340	100.0	95.0	100.0	.....
	1911	61.22	60.6	492	2,510	94.0	95.0	101.0	.....
Early Wonder	1911	50.13	59.4	499	2,260	98.0	104.0	100.0	14.68
Wellman Fife	1910	39.10	54.7	482	2,300	100.0	92.0	96.0	.....
	1911	52.63	57.6	487	2,280	99.0	98.0	100.0	14.84
Red Fife	1910	36.33	53.5	479	2,100	101.0	96.0	90.0	.....
	1911	61.97	58.8	504	1,880	96.0	75.0	80.0	11.34
Red Fife, Hybrid 71	1911	56.27	58.8	496	1,770	.....	.....	.....	14.28
,, ,, 847	1911	55.0	50.6	500	1,800	90.0	.....	.....	11.81
,, ,, 917	1911	57.57	57.6	492	2,080	90.0	80.0	80.0	14.28
,, ,, 1,017	1911	52.17	58.8	499	1,860	90.0	75.0	90.0	12.93
,, ,, 1,189	1911	52.77	57.6	503	1,770	90.0	.....	85.0	.....
,, ,, 8,198	1911	52.67	58.8	505	1,700	90.0	.....	80.0	13.00
,, ,, 8,515a	1911	51.4	58.8	508	1,680	90.0	80.0	80.0	.....
,, ,, 8,516	1911	53.90	58.8	511	1,780	90.0	80.0	80.0	.....
White Fife	1910	33.20	57.6	484	2,300	100.0	99.0	100.0	.....
	1911	54.57	58.8	492	2,510	98.0	103.0	102.0	14.92
Sorentina	1910	43.30	75.2	541	1,850	85.0	90.0	70.0	.....
	1911	55.50	63.2	523	1,500	.....	.....	.....	17.14
Roumania	1910	37.77	69.4	524	1,710	85.0	80.0	70.0	.....
	1911	55.33	63.2	510	1,400	.....	.....	.....	15.89
Kubanka	1910	34.87	66.5	511	2,100	90.0	85.0	84.0	.....
	1911	53.30	69.4	518	2,060	.....	.....	85.0	14.98
Arnantka	1910	38.57	66.5	515	1,920	90.0	85.0	75.0	.....
	1911	48.83	63.2	531	1,720	.....	.....	.....	.....
Jumillo	1910	40.30	75.2	545	1,660	80.0	85.0	70.0	.....
	1911	53.00	71.2	531	1,550	.....	.....	.....	15.55
Medeah	1910	40.23	77.1	554	1,870	90.0	85.0	70.0	.....
	1911	60.90	69.4	545	1,500	.....	.....	.....	15.47
Saxonka	1910	33.80	54.7	490	2,020	92.0	80.0	85.0	.....
	1911	54.40	57.6	493	1,800	.....	.....	80.0	14.68
Wild Goose	1910	39.23	66.5	510	2,280	90.0	96.0	90.0	.....
	1911	59.30	66.5	520	2,100	.....	90.0	80.0	.....

Soils. During the past summer I had the pleasure and privilege of visiting a number of the American State Experiment Stations to study the methods followed in investigating the complex problems of the soil. I found quite a diversity of opinion on certain lines of the work, but I hope to be able to devise a scheme of attacking the problem that will be suitable to our conditions. In the meantime, we are trying out some of the different methods of analysing soils in order that we may be prepared to go into the work more fully the coming year.

The samples of soils mentioned in last year's report, collected in Norfolk County, have been analyzed, but we will withhold any report on these until they have been more fully examined by newer methods.

We are frequently asked to analyze a small sample of soil submitted to us and to state what plant food constituents are lacking, and what kind of crops will do best on such a soil. Unfortunately, the analysis of a sample from any particular district will not give us this information. We would need to make an extended study of the soils of the district before we could give all the information which is desired, and, furthermore, there are a number of other conditions that come into the problem, besides the mere question of chemical composition, many of which cannot be studied on the spot.

In order that the farmer or fruit grower may become more familiar with the nature of the materials which form the active constituents of fertilizers, and at the same time gather information regarding the deficiency, if there be such, of plant food constituents in his soil, we recommend him to carry out a fertilizer experiment as follows:

Plot I.—No fertilizer.

Plot II.—Nitrate of soda .....200 lbs. per acre.
Muriate of potash .....200 " "
Superphosphate .....400 " "

Plot III.—Nitrate of soda .....200 " "
Muriate of potash .....200 " "

Plot IV.—Nitrate of soda .....200 " "
Superphosphate .....400 " "

Plot V.—Muriate of potash .....200 " "
Superphosphate .....400 " "

The size of the plots used in this experiment may be made to suit the convenience of the experimenter. In grains, if he wishes to carry out experiments with such, he may have a very small plot, say one rod by two rods, which will very much lessen the work of the threshing of the grain from the various plots. With potatoes, corn, mangels, the plot should be very much larger. It would be better if all the plots could be at least one-tenth of an acre in size. Muriate of potash and the superphosphate may be put on when the ground is being prepared, previous to seeding. About half the nitrate of soda may be worked into the soil at time of seeding. The balance may be put on some three weeks later. In the case of roots, just after thinning.

Such an experiment as outlined here when carefully conducted will give the farmer more information about the deficiencies of his soil than will an isolated chemical analysis of the soil, and at the same time he is becoming familiar with the active plant food constituents, which is a valuable point if he is to be successful in the use of these materials.

We have continued our fertilizer experiments in the peach and apple orchards, but full reports have not been made to us as yet. However, an examination of the plots while the fruit was on the tree indicate some very interesting results.

We also co-operated with several of the District Representatives in carrying out a large number of fertilizer experiments on corn, potatoes, turnips, mangels, and small fruits. The results received up to date indicate that some very valuable lessons may be learned from these experiments.

Cattle Feeds. There is abundance of evidence that many farmers are still ignorant of the conditions of the Commercial Feeding Stuffs Act. If the terms of the Act are being fulfilled, they should find stamped on every bag of commercial feeds, or printed on a tag securely fastened to the bag, a statement of the per cent. of protein, fat, and crude fibre contained in the feed. If they have reason to suspect that the guarantee is not correct, the Dominion Inland Revenue Department will analyze the material for a nominal fee. The sample, must, however, be taken according to directions given in the Act. The feeds included under the Act are also specified. I would, therefore recommend every farmer to procure a copy of the Commercial Feeding Stuffs Act from the Inland Revenue Department and become familiar with its contents.

Bran, shorts or middlings, and chop feed are not included in the feeds covered by the Commercial Feeding Stuffs Act. The adulteration of these products is to be dealt with under Section 26 of the Adulteration Act amended by Order-in-Council, October 29, 1910, and again on May 3rd, 1911, and now reads as follows:

"13. Bran is a product of the milling of wheat or other grain, and contains not less than fourteen (14) per cent. of proteids, not less than three (3) per cent. of fat, not more than ten (10) per cent. of crude fibre, and must be free from vital seeds of any of the noxious weeds defined by the Governor-in-Council under 'The Seed Control Act.'

"14. Shorts or Middlings is the coarser material sifted out from the products of a second treatment of the grain by crushing the coarsely ground material that is sifted out from the bran after the first grinding; and contains not less than fifteen (15) per cent. of proteids, not less than four (4) per cent. of fat, not more than eight (8) per cent. of crude fibre, and must be free from vital seeds of any of the noxious weeds defined by the Governor-in-Council under 'The Seed Control Act.'

"15. Chop-Feed is whole grain of one or more kinds more or less finely ground, and contains not less than ten (10) per cent. of proteids, not less than two (2) per cent. of fat, not more than ten (10) per cent. of crude fibre, and must be free from vital seeds of any of the noxious weeds defined by the Governor-in-Council under 'The Seed Control Act.'"

Well Water. We have again been called upon to analyze a number of samples of farm well water and must report that a large percentage of these waters are so polluted that they are not safe for domestic use. We are preparing a bulletin on this subject which we hope to have completed this winter. In the meantime, it may not be out of place to give a simple method for sterilizing water published in the Royal Army Medical Corps July, 1911, which may be very useful under some conditions. This method was worked out by Dr. G. G. Nasmith, Director of the Health Laboratories of the city of Toronto, and is as follows:—

"1. Take a teaspoonful of chloride of lime, containing about one-third available chlorine, and remove the excess of powder by rolling a pencil or other round object along the top of the spoon, or by flattening it with a penknife blade, so that the excess will be squeezed off.

"2. Dissolve the teaspoonful of chloride of lime in a cupful of water, making sure that all lumps are thoroughly broken up, and to it, in any convenient receptacle, add three more cupfuls of water.

"3. Stir up the mixture, allow to stand for a few seconds in order to let any particles settle (this stock solution, if kept in a tightly-stoppered bottle, may be used for four or five days), and add one teaspoonful of this milky stock solution to two gallons of the water to be purified in a pail or other receptacle. Stir thoroughly, in order that the weak chlorine solution will come into contact with all of the bacteria, and allow to stand for ten minutes. This will give approximately one-half part of free chlorine to a million parts of water, and will effectually destroy all typhoid and colon bacilli, or other dysentery-producing bacilli in the water. The water will be without taste or odor, and the taste of free chlorine added rapidly disappears."

In last year's report we stated that the Ontario grown spring wheats of the crop of 1910 made an inferior flour to that of the previous year. The 1911 crop was characterized by an unusually high percentage of gluten, which, unfortunately, was of a very poor quality. It was of a soft, sticky nature and its poor quality was very noticeable in the quality of the bread.

Insecticides and Fungicides. During the year a number of samples of various kinds of new and old insecticides and fungicides on the market were examined. Included in these was a sample of the new arsenical, zinc arsenite. The analysis indicate that this substance is a really high grade arsenical. A study is also being made of the changes that take place when the material is used with lime-sulphur wash.

In conclusion, I wish gratefully to acknowledge the hearty co-operation of the various departments of the College with which our work brought us in contact.

Respectfully submitted,

R. HARCOURT.

PART VII.

THE PROFESSOR OF VETERINARY SCIENCE.

To the President of the Ontario Agricultural College:

SIR,—I have the honor to submit my report for 1911-12.

CLASS ROOM.

1ST YEAR. During the fall term of 1911 I delivered to this class a course of lectures on Veterinary Anatomy, briefly though somewhat comprehensively considering the anatomy of the horse and the ox.

I also gave a course upon the erection of horse stables as regards site, drainage, ventilation and general internal arrangements, and upon the general care of horses as regards feeding, watering, grooming, shoeing, working, etc., and also spoke of the care of harness, saddles, carriages, &c., and in addition gave instructions in examining horses as to soundness, the desirable characteristics of the different breeds and classes of horses, and instructions in judging horses.

During the winter term of 1912 I gave a course of lectures on Veterinary Materia Medica, treating of the origin, properties, actions, uses and doses of the medicines that are used for the prevention and cure of the ordinary diseases to which farm stock is subject; also on the different forms in which medicines are administered, the different manners of administration and the advantages and disadvantages of each.

2ND YEAR. During the fall term I delivered to this class a course of lectures on Veterinary Medicine and Surgery, treating of the causes, symptoms and treatment (both preventive and curative) of the ordinary diseases of farm stock, thus enabling the students to diagnose and treat simple diseases and discriminate between a disease that requires only simple treatment and good care, and more serious diseases for the treatment of which the services of a Veterinarian are necessary.

During the winter term I gave a course on Veterinary Obstetrics, treating of the phenomena of conception, gestation, and parturition, the causes of sterility, with the means of removing those which are liable to yield to treatment, the causes of difficult parturition and the manner of removing or correcting them; the causes, symptoms, and treatment of the diseases of both sexes that are due to the act of reproduction; the symptoms and treatment of the young animal when suffering from diseases incident to such, and the general care of the same.

I also delivered a course upon the handling of colts and young horses, in order to prepare them for work. I illustrated the manner of controlling horses for the performance of simple operations, explained (and where practicable) illustrated the operations; explained and illustrated the different methods of administering medicines, and gave a course on judging horses.

4TH YEAR. To this class I gave instruction in judging horses, using the horses of the institution, those of my own stable and visiting the studs of dealers, breeders and importers.

Short Course in Stock Judging. This course, which was held in January, was well attended, and those who attended expressed themselves as being well satisfied. We gave practical courses in scoring and judging horses of the different breeds and classes. We have for such purposes some reasonably good draught horses, and a few pure-bred Clydesdale mares, but are dependent upon local breeders, owners and importers for horses to represent all other breeds and classes, and are indebted to Messrs. Sorby, McConnell, Hales, McMaster, Ryan, Stewart, Hurley, Palmer Bros., Parsons, Baker, Clancey, Ross, Dr. Grenside and Dr Harvey for those they kindly provided.

Injuries and Diseases of Stock. In the different classes of stock we had cases of the ordinary diseases, but they all yielded to treatment, and we had no losses except a few newly born animals.

I have, Sir, the honour to be

Your obedient servant,

J. H. REED.

PART VIII.

THE PROFESSOR OF DAIRY HUSBANDRY.

To the President of the Ontario Agricultural College:

SIR,—I beg leave to submit my twenty-second annual report of the Dairy Department of the College. This report contains a brief account of the investigational and experimental work done during the year.

The following are Applicants for Cheese and Butter Diplomas during the past year:

Name.	Address.	Diploma in
Armstrong, Marshall	Carthage	Cheesemaking
Arscott, W. J.	Whitechurch	Buttermaking
Calder, Martin	Gladstone	Cheesemaking
Carnochan, Peter	Bervie	Buttermaking
Coleman, W. A.	Ayr	Buttermaking
Conway, J. H.	Bright	Cheesemaking
Imlay, A. O.	Lawrence	Buttermaking
McKenzie, J. D.	Jarvis West	Buttermaking Cheesemaking
Smith, G. R.	Kintore	Cheesemaking

As in former years, we have supervised the official seven, fourteen and thirty days tests for the "Record of Merit" established by the Canadian Holstein Association.

Mr. L. A. Zufelt, Superintendent of the Dairy School at Kingston, has taken direct charge of the tests in Eastern Ontario, except those near Toronto.

CHEDDAR CHEESE INVESTIGATIONS AND EXPERIMENTS.

CASEIN AND FAT IN MILK DELIVERED AT ONTARIO CHEESERIES, SEASON, 1912.

Last year (1911) we began a series of investigations at representative cheese factories in the Province, both east and west. The work was continued during the season of 1912. Mr. R. W. Brown, an undergraduate in dairying of the College, was in charge of the work. We are indebted to Mr. Brown for his faithful, painstaking work. The following factories in Western Ontario were visited twice: Attwood, Tavistock, Burgessville, Banner, Dunboyne, and Bismarck. In Eastern Ontario, owing to limited time, but one visit was made at the following factories: Mountain View, Lansdowne, Caintown, Smith's Falls, Norwood, and Central Smith, near Peterboro'. We are under obligations to the owners and makers at these factories for their courtesy and co-operation in the work.

The outfit and general arrangements were similar to those of last year. It was planned to spend a week at each factory, taking samples daily from as many patrons as possible and testing these for casein and fat. A twelve bottle Hart casein tester was carried by the College representative, together with sample bottles for 48 patrons, and other necessary chemicals, except sulphuric acid, for the Babcock test. The Babcock testers and sulphuric acid were furnished by the factory owners. The work began at the Dominion, or Elma Factory at Attwood in the Listowell District on May 14th, and concluded at Dunboyne in the Simcoe group, on September 13th. Altogether about 3,500 tests were made for casein, and about

the same number of fat determinations, making a total of about 7,000 tests for the season. Patrons to the number of 282 had milk tested on the first round in Western Ontario in May and June, and most of these again in August and September. In Eastern Ontario, the milk from 222 patrons was tested between June 24th and August 3rd. There were altogether over 500 different patrons' milk tested during the season—those in Western Ontario twice. This should be fairly representative of the milk as delivered to the cheese factories during the season. From the mass of data collected we shall select for reporting on at present, the range and average of tests for the individual factories, both west and east, and leave the details for some further publication, as was done last year.

TABLE SHOWING HIGHEST, LOWEST AND AVERAGE PERCENTAGES OF CASEIN AND FAT IN TWELVE CHEESERIES, SEASON 1912.

Name of Factory.	Dates of testing.	Per cent. Casein in Milk.			Per cent. Fat in Milk.		
		Highest.	Lowest.	Aver'ge.	Highest.	Lowest.	Aver'ge.
WESTERN ONTARIO—							
Atwood (1)	May 14–18	2.9	2.0	2.27	4.8	2.9	3.45
Atwood (2)	Aug. 5–10	2.3	1.8	2.04	4.8	3.2	3.65
Tavistock (1)	May 20–25	3.1	1.7	2.32	4.4	2.5	3.45
Tavistock (2)	Aug. 12–17	2.7	1.7	2.13	4.4	2.8	3.52
Burgessville (1)	May 27 to June 1.	2.8	1.6	2.15	4.3	2.1	3.40
Burgessville (2)	Aug. 19–24	2.6	1.8	2.12	4.4	2.7	3.63
Banner (1)	June 3–8	2.6	2.0	2.23	3.9	2.8	3.48
Banner (2)	Aug. 26–31	2.6	1.9	2.27	4.3	2.8	3.49
Dunboyne (1)	June 10–15	2.9	1.9	2.31	4.3	2.1	3.30
Dunboyne (2)	Sept. 10–13	2.7	1.8	2.17	4.9	2.7	3.62
Bismarck (1)	June 17–22	2.6	1.8	2.28	5.8	2.5	3.67
Bismarck (2)	Sept. 4–7	(1) 2.7	1.8	2.24	4.9	3.0	3.83
Average of Western Ontario		2.71	1.82	2.21	4.6	2.67	3.54
EASTERN ONTARIO—							
Mountain View	June 24–29	2.6	1.8	2.10	4.7	2.7	3.54
Lansdowne	July 3–7	2.4	1.6	1.98	4.0	2.9	3.44
Caintown	July 8–13	2.3	1.6	1.92	4.2	2.9	3.46
Smith's Falls	July 17–20	2.5	1.8	2.18	5.3	3.1	3.57
Norwood	July 23–26	2.4	1.9	2.14	4.3	2.8	3.44
Central Smith	July 30–Aug. 2..	2.5	1.9	2.15	4.4	3.1	3.54
Average of Eastern Ontario		2.45	1.76	2.08	4.48	2.92	3.50
Average of Both Groups		2.58	1.79	2.14	4.53	2.79	3.52

(1) One day's test only for casein, September 4.

RELATION OF VAT TESTS FOR CASEIN AND FAT TO YIELD OF CHEESE.

During the season Mr. Brown made a number of tests of the milk in the vats at the various factories, for casein and fat, and wherever possible, he also got the weights of green cheese from these vats. Sometimes the weights of milk and cheese for several vats were grouped together as it was difficult to keep the curds separate from each vat when put to press. Altogether, fourteen tests were made on vats ranging in weights of milk contained, from 3,944 lbs. to 22,560 lbs. The percentages of fat in the milk of these vats ranged from an average of 3.45 to 3.72; the casein from an average of 1.96 to 2.4. The pounds of cheese in one lot, or

made from one vat or group of vats, varied from 345.5 lbs. to 2,024.75 lbs. The range in the pounds of cheese per pound of fat and casein in the milk was 1.44 to 1.67 and averaged for the series, 1.59 lbs., which is about what we have found in our work at the Dairy Department of the College, except that our figures are based on weights of cheese one month old whereas the foregoing results are based on weights of green cheese. It was not practicable to obtain weights of ripened cheese for these tests at factories.

The Composite Sample for Casein and Fat Determinations.

The composite method of sampling has been quite generally accepted for fat determinations at factories where partrons are "paid by test". Last year we reported on composite sampling for casein tests and said: "Up to the present we cannot recommend composite sampling at cheese factories for casein determinations by the Hart method."

The work was repeated during the season of 1912. The table shows the pounds of casein and fat credited by daily and composite tests. In a few cases the composite tests were not considered reliable for various reasons and these have been left out of the calculations. The figures after the names of the factories in Western Ontario indicate whether the composite tests were made at the first, or second visit, or both. Ten patrons' milk at each factory were tested in this way. The plus sign (+) under the Difference columns, indicates pounds of casein or fat, too great, credited by the composite tests. The minus sign (—) indicates pounds too little, credited by the composite sampling. In all cases the fat credited by composite samples was within the limits of error, the greatest difference being 11.573 (+) at the Central Smith Factory, on over 300 lbs. of milk-fat. The casein results are closer than for last year. The widest difference was 31.446 lbs. (+) at Caintown factory on about 230 lbs. casein. At all the other factories, the results are reasonably accurate, and indicate that with care, and keeping the samples in a cool place, composite sampling for 4 to 6 days might be practicable for casein tests at factories.

Comparison of Results in Casein and Fat Credited by Daily and Composite Sampling. Ten Patrons Each Factory.

Name of Factory	Lbs. Casein Credited by			Lbs. Fat Credited by		
	Daily Tests.	Comp. Test.	Difference.	Daily Tests.	Comp. Test.	Difference.
Atwood 1	.....	.....	.....	354.753	359.367	4.614+
Atwood 2	188.179	195.133	6.954+	375.550	373.269	2.281−
Tavistock 1	.....	.....	.....	232.752	234.221	1.468+
Tavistock 2	148.515	163.456	14.941+	243.308	245.040	1.732+
Burgessville 1	209.854	212.925	3.171+	314.231	322.875	8.644+
Burgessville 2	136.349	139.632	3.283+	232.729	234.775	2.046+
Banner 2	204.625	211.031	6.406+	304.749	311.166	6.417+
Dunboyne 1	185.304	191.507	6.203+	255.415	256.648	1.233+
				(2) 195.028	195.225	.197+
Bismarck 1	102.210	94.772	7.438−	157.874	157.639	.235+
				(2) 128.690	128.275	.415−
Mountain View	220.027	209.184	12.843−	374.430	372.493	1.937−
Lansdowne	104.113	101.325	2.788−	178.599	179.816	1.217+
Caintown	228.429	259.877	31.446+	422.811	423.577	.766+
Smith's Falls	170.747	185.547	14.800+	278.404	275.400	3.004−
Norwood	141.055	141.666	.605+	221.567	218.648	2.919−
Central Smith	191.151	191.586	.435+	303.925	315.498	11.573+

Conclusions.

1. The highest percentage of casein found in any single sample of milk was 3.1, the lowest 1.6. The highest average percentage of casein of several tests in any one patron's milk was 3.02, the lowest 1.75. The percentages of fat in samples of milk tested, ranged from 2.1 to 5.8. The figures indicate quite a wide range in casein and fat for factory milks and show the need of testing to do justice.

2. The average percentages of casein and fat in the milk delivered at the Western Ontario factories visited, and under the conditions given, were respectively, 2.21 and 3.54; for Eastern Ontario, 2.08 and 3.50. The averages for both groups were 2.14 per cent. casein and 3.52 per cent. fat. In the season of 1911 the averages for Western Ontario factories tested was, 2.26 per cent. casein, and 3.42 per cent. fat; for Eastern Ontario 2.1 and 3.5; the averages for both groups in 1911 were 2.22 per cent. casein and 3.44 per cent. fat. The results are similar for both years. The season of 1911 was very dry and for 1912 very wet. Comparing the results at Atwood factory for the two seasons, this being the only factory in Western Ontario visited both years, we find the milk during the season of 1911 averaging 2.23 per cent. casein and 3.31 per cent. fat; for 1912 the averages are 2.15 per cent. casein and 3.55 per cent. fat. In the Eastern group, three factories were visited both seasons. The averages for 1911 in these factories were 2.1 per cent. casein and 3.44 per cent. fat; 1912 averages were 2.05 and 3.51. So far as these results show, they do not indicate any marked effect of season upon the casein and fat content of milk.

3. So far as we were able to obtain weights and tests of milk, and weights of cheese, from the vats at the factories, the average pounds of green cheese made from one pound of fat and casein in the milk was 1.59. The extreme variations either way from this figure were about one-tenth of a pound of cheese.

4. The composite plan of sampling for Hart casein tests gave more satisfactory results in 1912 as compared with 1911, but we are not prepared to recommend it for general factory work at present. It would seem as if composite samples for casein tests, may be kept for a week, if a small amount of preservative (potassium bi-chromate), be used and the bottles kept in a cool dark room.

5. The variations found in the fat and casein of milks as delivered to factories in Ontario warrants the keeping up of the agitation in favor of testing and paying for milk on the basis of the test or tests made, in order to discourage tampering with the milk, and to encourage the production of milk of good quality and paying for the same on the basis of its cheese producing capacity, which for practical purposes is determined by the fat and casein contained in it.

Fat and Casein Investigations in Nine Patron's Milk Delivered at *O. A. C.*, By Months, Season, 1912.

This is the fifth season of this work. Samples were taken several times each month from each patron's milk delivered to us during the season. These samples were tested for both fat and casein by means of the Babcock (fat) and Hart (casein) methods. The lowest monthly average percentage of fat found in one patron's milk was 3 (No. 8) in the month of June. The highest monthly average percentage of fat was 4.3, which occurred in three different patrons' milk (Nos. 4, 8, and 9) during three different months (April, May, and Oct.) of the season. The lowest average percentage of casein during any one month was 1.9 which occurred in two patrons' (Nos. 1 and 3) during two months (June and July).

The highest average percentage of casein was 2.6 in the milk of patron No. 9 in the month of Sept. By months the highest averages for fat percentage in the milk delivered, was during Aug. and Sept., while the casein averaged highest during Sept. and Oct.

The table shows the monthly averages for each patron and for all the partrons and also the season averages for fat and casein percentages:

No. of Patron.	April.		May.		June.		July.		August.		Sept.		October.		Season.	
	Fat.	Casein.	Fat.	Casein.	Fat.	Casein.	Fat.	Casein.	Fat.	Casein.	Fat.	Casein.	Fat.	Casein.	Fat.	Casein.
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
No. 1	3.2	2.1	3.3	2.0	3.5	1.9	3.8	2.3	3.7	2.2	3.6	2.3	....	....	3.3	2.1
No. 2	3.4	2.0	3.8	2.2	4.1	2.2	3.9	2.1	4.0	2.3	3.9	2.2	4.2	2.2	3.9	2.1
No. 3	3.3	2.1	3.3	2.0	3.2	2.2	3.2	1.9	3.6	2.2	3.9	2.4	3.4	2.6	3.4	2.2
No. 4	4.1	2.2	4.3	2.4	3.9	2.2	3.9	2.3	4.2	2.3	4.0	2.3	4.0	2.4	4.0	2.3
No. 5	3.9	2.2	3.5	2.0	3.6	2.0	3.8	2.0	3.5	2.2	4.2	2.4	3.7	2.3	3.7	2.1
No. 6	3.6	2.1	3.5	2.0	3.1	2.0	3.2	2.1	3.4	2.2	3.7	2.3	3.4	2.4	3.4	2.1
No. 7	4.3	2.4	3.9	2.1	3.7	2.3	3.8	2.2	3.8	2.3	3.9	2.3	3.8	2.5	3.9	2.3
No. 8	....	....	3.1	2.0	3.0	2.0	3.1	2.0	3.3	2.1	3.5	2.2	3.4	2.3	3.2	2.1
No. 9	....	....	3.9	2.2	3.8	2.2	3.3	2.1	3.4	2.3	3.8	2.6	4.3	2.4	3.7	2.3
Averages	3.6	2.1	3.6	2.1	3.5	2.1	3.5	2.1	3.8	2.2	3.8	2.3	3.7	2.3	3.61	2.18

Comments.

1. The averages for milk-fat and casein for the season of 1911 were 3.77 and 2.37; for 1912, 3.61 and 2.18 respectively. The season of 1911 was a very dry one; 1912 a very wet season. These results do not coincide with the theory that a dry, hot season tends to produce milk with low fat and casein contents and a wet season the reverse.

2. As in previous years, the milk during the months of September and October tends to be relatively higher in fat and casein content, due, doubtless, to advancing lactation among cows, consequently less milk is required to make a pound of cheese than is the case earlier in the season.

Vat Tests of Casein and Fat, 1912, O.A.C.

This is the fifth year during which tests were made for fat and casein in the vats of milk used for cheesemaking at the Dairy Department of the College.

The averages of these vat tests during the past five years are as follows:

Year.	Average per cent.	
	Casein.	Fat.
1908	2.39	3.67
1909	2.50	3.60
1910	2.46	3.60
1911	2.30	3.58
1912	2.17	3.56

These results show a tendency towards lower average percentages of both casein and fat in the milk as delivered to us, by practically the same patrons during the five years of these tests. Last year we said this was probably due to the very dry season. But the season of 1912 was a very wet one and still the averages of casein and fat in the milk are lower than for the season of 1911. Apparently there is some other factor at work causing these decreases. The average pounds of milk required to make a pound of cheese in 1911 was 10.8; for 1912 it was 10.79, or practically the same. The total pounds of milk received for cheesemaking in 1912 was 113,291, from which were made 10,490 pounds of cheese.

Month.	No. of tests	Per cent. casein in milk.		Per cent. fat in milk.		Lbs. milk per lb cheese.	% fat in whey.	Average lbs. cheese per lb.	
		Range.	Average.	Range.	Average.			Fat.	Casein.
April	15	2.1 to 2.3	2.2	3.4 to 3.6	3.5	11.12	.22	2.56	4.09
May	22	2.0 to 2.3	2.1	3.4 to 4.0	3.6	11.11	.19	2.5	4.02
June	36	2.0 to 2.5	2.2	3.2 to 4.0	3.7	10.59	.17	2.54	4.06
July	31	1.9 to 2.4	2.1	3.2 to 4.0	3.4	11.22	.17	2.58	4.15
Aug.	20	2.0 to 2.4	2.2	3.3 to 3.9	3.6	11.43	.19	2.43	3.9
Sept	10	2.1 to 2.6	2.4	3.6 to 3.9	3.8	10.01	.20	2.52	4.11
Oct	9	2.2 to 2.6	2.5	3.6 to 4.4	4.0	9.68	.16	2.58	4.14

Comments.

During the season 143 tests were made for fat and casein in the vats of milk at the cheese room. The lowest percentage of casein found was 1.9 and the highest 2.6. The fat in these milks ranged from 3.2 to 4.4 per cent. The lowest averages by months were 2.1 per cent. casein for May and July and 3.4 per cent. fat in July. The highest averages for both casein and fat, 2.5 and 4, were in the month of October. The average pounds of milk required to make a pound of cheese were also least in October, viz., 9.68. The highest average was 11.43, for August. The average pounds of cheese per pound of fat in the milk are fairly uniform, ranging from 2.43 in August to 2.58 in July and October. The pounds of cheese per pound of casein in the milk are higher than last year, ranging from 3.9 in August to 4.15 in July. Last year the range was 3.69 in April to 4.05 in September.

High and Low Casein and Fat in Milk for Cheesemaking. Fifth Year's Results of Comparative Tests.

The milk low in fat and casein was put into A vat and that high in fat and casein was put into B vat. There were 18 experiments made in all, using 18,284 lbs. milk. "A" vat contained a total of 9,142 lbs. milk testing an average of 3.42 per cent. fat and 2.09 per cent. casein; B vat contained 9,142 lbs. milk testing an average of 3.84 per cent. fat and 2.36 per cent. casein.

The results summarized are as follows:

—	Lbs. Green Cheese	Lbs. Ripe Cheese	Lbs. Shrinkage	Average % Shrinkage	Lbs. Cheese per 1000 lbs. Milk	Lbs. Milk per lb. Cheese
A.....	853	829.19	23.91	2.803	90.70	11.02
B.....	905.13	879.77	25.36	2.801	96.23	10.39

—	Lbs. Cheese per lb. fat in milk	Lbs. Cheese per lb. casein in milk	Av. % fat in cheese	Average % moisture in		Av. % fat in whey
				Green Cheese	Ripe Cheese	
A.....	2.64	4.33	35.45	34.5	34.5	.2
B.....	2.50	4.02	36.49	34.5	34.5	.2

SCORE OF CHEESE

—	Flavor (40)	Closeness (15)	Even Color (15)	Texture (20)	Finish (10)	Total (100)
A.....	36.98	14.06	14.15	16.91	10	92.09
B.....	36.96	14.15	14.35	17.26	10	92.97

CONCLUSIONS.

1. The yield of cheese per 1,000 lbs. milk was 5.53 lbs. greater from the B lots, containing an average higher percentage of .42 fat and .17 casein, as compared with the A lots. In 1910 and 1911 the differences in yield of cheese were respectively 4.64 and 6.4 lbs. more per 1,000 lbs. milk, from the higher casein and fat lots of milk.

2. As in 1911 the cheese made from the higher casein and fat lots of milk, contained a higher average per cent. of fat—one per cent.

3. The average percentage of moisture in the cheese was the same for both lots, 34.5.

4. There was not much difference in the quality of the cheese. The B lots scored an average of .88 of a point higher.

NORMAL VS. OVERRIPE MILK FOR CHEESEMAKING.

This is the fifth year for conducting these experiments.

The milk that was delivered to the Dairy Department of the College in an "overripe" condition was made into cheese in the usual way. These results were compared with those got from normal milk on the following day which arrived in good condition. As explained in previous reports, this method is not scientifically correct, but it approximates factory conditions.

There were eighteen tests made altogether, nine of each, for which were used 24,254 lbs of milk. 13,934 lbs. were manufactured in the A vat, or overripe lots. This milk tested an average of 3.56 per cent. fat and 2.17 per cent. casein. 10,311 lbs. milk were used in the B vats, or normal lots, testing an average of 3.53 per cent. fat and 2.20 per cent. casein. Both lots were similar in average composition so far as fat and casein are concerned.

	A	B
Lbs. of Milk	13,943	10,311
Acidity at setting.....per cent.	.221	.176
Time in whey	52 Mins.	2 Hrs. 46 Mins.
Acidity at dipping.....per cent.	.178	.176
Green Cheese.....lbs.	1,272.57	970.95
Ripe Cheese.....lbs.	1,235.82	946.65
Shrinkage { .....lbs.	36.75	24.32
Shrinkage { .....per cent.	2.88	2.40
Lbs. of Cheese per 1,000 lbs. of Milk	88.63	90.83
Lbs. of Milk per lb. of Cheese	11.28	10.89
Per cent. Moisture in Green Cheese	34.70	34.73
Per cent. Moisture in Ripe Cheese	34.63	34.63
Loss of Moisture in one Month	.07	.10
Score of the Cheese: Max.		
Flavor 40	36.56	36.16
Closeness 15	14.36	14.50
Even Color 15	14.05	14.88
Texture 20	17.52	17.77
Finish 10	10	10
Total 100	92.49	93.31

Conclusions.

1. The overripe milk of similar composition to that in normal condition produced 2.2 lbs. less cheese per 1,000 lbs of milk. The two previous years the differences were 2.4 and 2.5 lbs. less per 1,000 lbs. milk from the overripe lots.

2. Both lots contained practically the same percentages of moisture in both green and ripe cheese.

3. The quality of the cheese was inferior in all cases, which was made from the overripe milks.

4. To increase the yield of cheese and improve the quality, it is important that patrons of cheeseries shall cool the milk on the farm so as to have it arrive at the factory in a sweet condition.

Effect of Acid at Time of Adding Rennet to Milk.

This is a continuation of the work done during the past two years. Six experiments were made, using in all, 6,866 lbs. of milk testing an average of 3.4 per cent. fat and 2.1 per cent. casein. The milk was thoroughly mixed then divided into two lots. "A" vat was ripened above normal; B was set at about normal percentage of acid. The experiments began April 24th, and were completed Aug. 6th.

	A	B
Lbs. of milk	3,433	3,433
Acid at setting.....per cent.	.1925	.165
Acid at dipping.....per cent.	.1675	.165
Acid at milling.....per cent.	.625	.625
Acid at salting.....per cent.	.96	.91
Hours in whey	1 hr. 21 mins.	2 hrs. 50 mins.
Hours from dipping to salting	4 hrs. 18 mins.	4 hrs. 16 mins.
Loss of fat in whey	.16%	.18%
Green cheese.....lbs.	321.89	321.64
Ripe cheese.....lbs.	312.38	311.69
Shrinkage.....lbs.	9.51	9.95
Shrinkage.....per cent.	2.954	3.093
Cheese, per 1,000 lbs. of milk	90.99	90.81
Milk, per lb. of cheese	10.98	11.01
Score of the Cheese: Max.		
Flavor..... 40	36.92	36.84
Closeness..... 15	14.15	14.03
Even color..... 15	14.31	14.19
Texture..... 20	17	17.30
Finish..... 10	10	10
Total.....100	92.38	92.36

Conclusion.

So far as these tests are concerned there was very little difference in the results. The average yield and quality of the cheese were practically the same in both lots.

Effect of Acid at Time of Dipping.

There were eight experiments made from April 9th to Aug. 13th, using 9,322 lbs. milk testing 3.5 per cent. fat and 2.13 per cent. casein. The milk was thoroughly mixed then divided into two lots and treated alike, except at the time of dipping. The A lots were given the more acid.

	A	B
Weight of milk.....lbs.	4,661	4,661
Per cent. acid at setting	.165	.165
Per cent. acid at dipping	.191	.164
Per cent. acid at salting	.933	.9
Loss of fat in whey	.15%	.17%
Pounds of cheese per 1,000 lbs. of milk	93.86	94.26
Pounds of milk to 1 lb. of cheese	10.65	10.60
Green cheese.....lbs.	450.	451.03
Ripe cheese.....lbs.	437.51	439.38
Shrinkage { Lbs.	12.49	11.65
Shrinkage { Per cent.	2.77	2.55
Per cent. moisture in curd	48.7	51.1
Per cent. moisture in green cheese	35.	35.06
Per cent. moisture in cured cheese	34.87	34.96
Average Score of Cheese: Max.		
Flavor..... 40	36.66	37.23
Closeness..... 15	14.16	14.13
Even color..... 15	14.16	14.33
Texture..... 20	17.26	17.46
Finish..... 10	10.	10.
Total..... 100	92.24	93.15

Conclusions.

1. An average increase of .027 per cent. acid in the whey at the time of dipping, or removal of the curd from the whey, reduced the yield of cheese per 100 lbs. of milk by .4 lb. Last year the reduction was .42 lb., and the previous year it was .733 lb. All three years results emphasize the importance of separating curd and whey when comparatively sweet in order to have a "good average," or lessen the weight of milk required to make one lb. of cheese.

2. The lots dipped with high acid had greater loss of fat in the whey, greater shrinkage, less moisture in curd and cheese, and scored an average of nearly one point less.

Effect of Varying Weights of Salt Applied to Curds.

This is a continuation of work done in 1911. In all cases the milk was made into cheese in the usual way. At the time of salting, the curd was divided into two or three lots, according to the weight of milk used, and different rates of salt were added, commencing with 2 (*a*), 2¼ (*b*), and 2½ (*c*), lbs. for 1,000 lbs. of milk in the early part of the season. Later, this was increased to 2¼ (*a*), 2½ (*b*), and 2¾ (*c*) lbs. salt per 1,000 lbs. of milk. Altogether there were eleven experiments in which were used 9,421 lbs. of milk testing an average of 3.56 per cent. fat and 2.13 per cent. casein.

—	Weight of Cheese.			Per cent. of Moisture in Cheese.		
	Low A. Salting.	Medium B. Salting.	High C. Salting.	A.	B.	C.
	Lbs.	Lbs.	Lbs.			
Green	393.52	394.57	100.5	34.7	34.14	33.2
Ripe.....	381.08	381.71	98.38	34.63	33.99	33.08
Shrinkage	12.44	12.86	2.12	.07	.15	.12

—	Flavor 40.	Closeness 15.	Even Color.	Texture 20.	Finish 10.	Total 100.
A.....	37.55	14.10	14.16	17.56	10	93.37
B.....	37.21	14.22	14.24	17.44	10	93.11
C.....	37.34	14.14	14.14	17.46	10	93.08

Conclusions.

This is the fifth year for conducting these experiments.
3,256 for the medium salted lots and 2.1 for the high salting lots, indicating that increasing the salt reduces the loss by shrinkage during the ripening.

2. There was a slight decrease in the moisture content of the cheese, both green and ripe, as the salt was increased.

3. There was not much difference in the quality of the cheese from the methods of salting. The lots which were highly salted averaged slightly higher in the scores than did the other lots.

Loss of Moisture in Various Parts of Cheese During One Month Ripened in Ice-cold Storage and Ordinary Ripening Room.

This work is similar to that done last year. Two cheese were made from similar milk on each of the following dates: May 22, July 8, Aug. 5, and Sept. 18. One cheese was placed in ice-cold storage where the temperature of the air in the room averaged about 40 degrees F. The other cheese was placed in our regular ripening (curing) room, where the temperature ranged 60 degrees to 75 degrees. The cheese were sampled weekly, to determine the percentage of moisture, for a month, except the August cheese, from which only two samples were taken after the green cheese was tested. A plug of cheese was removed from one end of the cheese, and this was cut into three inch lengths and the moisture determined in each inch of the plug by means of a steam drying oven. The first inch of each plug of cheese included the rind.

The results of the tests are shown in the table:

Dates	Cheese ripened in ice-cold storage at 40°.						Cheese ripened in ordinary room at 60 to 75°F.					
	Green cheese	Per cent. moisture in—					Green cheese	Per cent. moisture in—				
		Green cheese	1st inch, including rind.	2nd inch.	3rd inch.	Average.		Green cheese	1st inch, including rind.	2nd inch.	3rd inch.	Average.
	Lbs.						Lbs.					
May 22..	76	35.	.....	.....	.....	.....	77	35.	.....	.....	.....	.....
" 30..	.....	.....	32.8	34.8	34.4	34.	.....	.....	32.2	34.6	34.7	33.8
June 6..	.....	.....	33.5	35.4	35.2	34.7	.....	.....	31.6	34.7	34.8	33.7
" 13..	.....	.....	30.6	34.8	36.6	33.6	.....	.....	30.6	34.9	34.6	33.3
" 20..	.....	.....	33.6	34.1	34.6	34.3*	.....	.....	29.2	34.5	34.8	32.8
" 27..	.....	.....	31.6	34.8	35.	33.1	.....	.....	27.8	34.6	35.	32.4
Averages	.....	.....	32.4	34.7	34.5	33.9	.....	.....	30.2	34.6	34.7	33.2
July 8..	74	33.6	.....	.....	.....	.....	75	35.6	.....	.....	.....	.....
" 15..	.....	.....	32.8	34.	33.6	33.4	.....	.....	32.5	33.8	33.6	33.3
" 22..	.....	.....	30.4	33.8	33.6	32.6*	.....	.....	30.	33.9	33.6	32.5
" 30..	.....	.....	33.6	33.4	33.8	33.6	.....	.....	29.	33.8	33.9	32.2
Aug. 5..	.....	.....	30.2	33.6	34.	32.6	.....	.....	29.3	34.	33.9	32.4
Averages	.....	.....	31.7	33.7	33.7	33.	.....	.....	30.2	33.8	33.7	32.6
Aug. 6..	79	35.	.....	.....	.....	.....	79	34.6	.....	.....	.....	.....
" 12..	.....	.....	34.6	34.8	34.6	34.6	.....	.....	34.6	34.6	34.4	34.5
" 31..	.....	.....	29.8	34.6	34.8	33.	.....	.....	29.4	34.5	34.4	32.7
Averages	.....	.....	32.2	34.7	34.7	33.8	.....	.....	31.3	33.	33.9	33.6
Sept. 18..	72	34.6	.....	.....	.....	.....	71	34.4	.....	.....	.....	.....
" 26..	.....	.....	32.	34.2	34.2	33.4	.....	.....	32.8	34.8	34.4	34.
Oct. 7..	.....	.....	34.	34.	34.2	34.*	.....	.....	33.	34.4	34.2	33.8
" 14..	.....	.....	32.4	34.2	34.	33.3	.....	.....	30.	34.2	34.3	32.8
" 21..	.....	.....	31.2	34.2	34.1	33.1	.....	.....	31.	34.6	34.4	33.3
Averages	.....	.....	32.4	34.1	34.1	33.45	.....	.....	31.7	34.5	34.3	33.72

* Cheese turned on this date and samples taken from other end.

Conclusions.

1. The cheese ripened in the cold-storage retained more of the original moisture in the cheese at the end of one month than did the cheese ripened in the ordinary ripening room.

2. Most of the loss of moisture in both lots took place from the first inch of the cheese, which included the rind. The greatest loss was during the first week of ripening.

3. The results of two seasons' work agree in showing that the loss of moisture from a cheese during ripening takes place nearly altogether from the surface, and that the moisture in the centre of the cheese remains fairly constant for at last a month.

Ripening Cheese in Cold Room vs. Ordinary Room.

These experiments are a continuation of the work done last year on this question. The milk for each test was put into one vat and made into three cheese. The A cheese was taken directly from the hoop to the cold room and not turned. The B cheese was placed in the ordinary room for a week then placed in the cold room. The C cheese was left in the ordinary room for one month. There were twelve experiments made, using 10,577 lbs. milk testing an average of 3.56 per cent. fat and 2.12 per cent. casein. The average per cent. of fat in the whey was .2.

The table shows the main results:

—	Green cheese. Lbs.	Ripe cheese. Lbs.	Shrinkage.		Moisture in	
			Lbs.	%	Green cheese.	Ripe cheese.
					%	%
A	431.27	418.45	12.82	2.97	34.6	34.4
B	141.94	137.69	4.25	3	34.56	34.15
C	419.12	404.13	14.99	3.57	34.6	34.4

Score of Cheese.

—	Flavor. (40)	Closeness. (15)	Even color. (15)	Texture. (20)	Finish. (10)	Total. (100)
A	37.07	14.34	14.45	17.74	10	93.60
B	37.21	14.28	14.5	17.21	10	93.2
C	35.97	13.95	14.06	16.41	10	90.39

Conclusions.

1. There was a saving of about one-half of one per cent. shrinkage in one month by placing the cheese in a room at about 40 degrees F., as compared with ripening the cheese at 60 degrees to 70 degrees F.

2. There was not much difference in the average percentage of moisture in each of the three lots, whether in a green or ripe condition (1 month old).

3. The quality of the cheese was superior in the lots ripened at a comparatively low temperature. The average score of the cheese placed in an ice-cold storage at about 40 degrees F., directly from the hoops, was over three points higher than was the average score of those lots ripened in an ordinary room. There was not much difference in the average scores of the cheese placed at once in cold-storage as compared with those placed in the cold room at the end of one week. Both of these plans are likely to prove quite satisfactory.

Soft Cheese Experiments.

During the past summer season a number of experiments were conducted with reference to various methods in the manufacture of soft and fancy cheese by Mr. Golding. As intimated in my report of last year, the Soft and Fancy cheese trade in Canada is comparatively new and small as yet, although we import quite large quantities of these cheese each year into Canada. The trade seems to prefer the imported cheese to that of home manufacture. In our experience the chief difficulty is to prevent the cheese spoiling during hot weather. Our trade drops off almost entirely during July and August, while during the cooler months we have a fairly good demand for all we have capacity to manufacture.

One of the methods tried by us was to make the Camembert (fresh) cheese from pasteurized milk and the Gervais from pasteurized milk and cream as this seems to prevent the gassy fermentation so common in hot weather. At the same time we were able to make cheese of good flavor and texture. Cream cheese of good quality can also be made from pasteurized cream.

The average of four experiments with Camembert, two with Gervais and one with cream cheese, where one lot of each was made by using raw milk or cream, and the other by using pasteurized milk or cream, gave the following results:

Kind of cheese.	Av. % fat in milk or cream.	Av. lbs. cheese per gal. milk or cream.	Av. % moisture in cheese.	Av. % fat in cheese.	Av. lbs. cheese per lb. fat in milk or cream.	Remarks.
Camembert . Past. 150°	3.45	1.94	63.3	19.5	5.62	Texture good, good flavor, no gas.
Camembert . Raw	3.47	1.89	61.5	19.7	5.39	Fair to good, slightly gassy, texture fair to good.
Gervais .... Past. 150°	8.9	2.34	47.7	40.25	2.66	Firm cheese, good flavor, slightly cooked smell.
Gervais .... Raw	8.9	2.34	49.1	42	2.66	
Cream ..... Past. 150°	22	3.41	29.5	65	1.56	Flavor good.
Cream ..... Raw	22	3.37	29.7	62	1.54	" "

Comments.

1. The yield of cheese was slightly greater by adopting pasteurization for Camembert and Cream cheese. In the case of the Gervais there was no difference in yield of cheese whether the mixed milk and cream were pasteurized or not.

2. In the case of the Camembert, the cheese made from pasteurized milk contained 1.8 per cent. more moisture and less fat as compared with raw milk cheese. The Gervais and cream cheese had more moisture in the raw lots, while the fat was higher in Raw Gervais and lower in the Raw cream lots. The results are not conclusive.

3. The quality of the cheese was better on the whole, when made from the pasteurized milk or cream as compared with that made from the raw milk or cream.

Pressing *vs.* Not Pressing Gervais and Cream Cheese.

Seven experiments were made comparing the effect of applying a seven pound weight to Gervais cheese after salting, with simply hanging the cheese up to drain. Six similar experiments were made with cream cheese.

The averages of the main points in these tests were as follows:—

Kind of cheese.	Pressing.	Av. weight of dry cheese.	Av. % moisture in cheese.	Av. % fat in cheese.	Av. lbs. cheese per lb. fat in milk or cream.	Remarks.
		lbs.				
Gervais, milk and cream, 9.66 % fat	Not pressed	2.86	50.7	38.26	2.65	Too soft. Firm enough.
	7lbs. weight	2.53	44.7	43.03	2.35	Firm. Too firm.
Cream, 21.6 % fat.	Not pressed	3.92	38.79	54.33	1.89	Soft. Too soft.
	7lbs. weight	3.49	36.20	56.10	1.68	Correct firmness.

Comments.

1. The addition of a seven pound weight to the cheese after salting for about 24 hours reduced the yield of cheese, as compared with hanging the cheese to drain, but it seemed to give the correct degree of firmness to the cream cheese. The Gervais made from part milk and part cream were all right in most cases without the weight.

2. The extra yield of cheese from the lots not pressed appears to be due to extra moisture in the cheese. The lots pressed contained a higher percentage of fat than did those not pressed.

Ripening Camembert Cheese.

The true Camembert cheese is one which has passed through the ripening process until the inside of the cheese is almost like cream which is covered with a skin of tough, curdy material.

We sell practically all our Camembert cheese in a fresh state, but we conducted some experiments during the past season (May to August) to ascertain if we could produce these cheese in a satisfactory ripened condition. Six tests were made by using raw fresh milk. The fresh cheese contained from 54.3 to 63 per cent. moisture. They were innoculated with the Camembert bacteria for ripening before salting. The cheese were kept for two or three weeks at a temperature of 55° to 60°F., in a room where the humidity ranged from 85 to 89 per cent. The mould began to appear on the cheese in about a week after inoculating. They were examined at the end of two or three weeks. The cheese made during May and June were of very fair quality as to texture, but the flavor was slightly bitter. Those made in July were of bad flavor when examined. A lot made August 17th was of good flavor and texture when tested on August 31st.

Conclusions.

Until we know more about the making and ripening of Camembert cheese in ripened form we would not advise their production. The fresh cheese are safer, and the returns are received more quickly.

Stilton Methods of Cheesemaking.

Three methods of making Stilton cheese were tested during the past season viz.: "Cloth," "Curd Knife," and "Wensleydale." These cheese were made chiefly during the months of June and July, which are considered to be the best months for making Stilton cheese. At the time of completing this report (December 2nd) none of the "Wensleydales" and only part of the cheese made by the other systems are ripe, as it usually takes four to six months for these cheese to develop the blue mould and become softened like butter, which are the chief characteristics of a Stilton cheese. The cheese made by the first two methods, "cloth" and "curd knife," have ripened more quickly than have those made on the "Wensleydale" plan, which latter appear to be much firmer and have little or no mould at the end of about six months. In consequence, we shall be unable to report on this work at present. I may add that we have sold a number of Stiltons during the past year to customers who are pleased with them and gladly paid twenty-five cents a pound for them. It is also fair to say that a number of these cheese were unsatisfactory and had to be sold at a low price. Up to the present, Stilton cheese manufacture in Canada appears to be in the experimental stage. Whether or not we shall be able to make a uniformly good cheese, and equal to the English Stilton, remains to be seen.

MILK AND CREAM TESTING.

Samples Milk and Cream Tested During Year.

As usual, we have received during the past year a large number of samples of milk and cream to be tested, chiefly for fat. The number of whole milk samples tested was 69, cream 95, and skimmilk 9, total 173. A great many samples received are broken during transit and a number have little or nothing to indicate where they came from. Sometimes we can make out the post office or express office of the sender, but that is all. We may repeat what we have written in former reports with reference to these samples:

1. Secure a representative sample by mixing or pouring.
2. Fill sample bottle full to prevent churning.
3. Pack safely in wooden box or place in mailing case to prevent breakage. (The P. O. Department prohibits the mailing of liquids which may spoil other mail matter by breaking, unless properly packed.)
4. Be sure to give name and P. O. address of sender. We cannot report on the test of a sample unless we know who sent it. We frequently have requests for information, bulletins, etc., from persons who do not sign their names to letters or post cards.

Aliquot vs. Ounce or Uniform Sampling of Cream for Composite Samples.

To ascertain what difference, if any, there would be by taking aliquot or proportionate samples and ounce samples or the same quantity from each delivery,

we selected three patrons delivering cream in individual cans, and from each delivery took two samples for composite samples. For the aliquot sample, we took one cubic centimetre for each pound of cream delivered; and for the other sample we used a small dipper of about 40 c. c. capacity. These samples were kept in cork stoppered bottles in cold storage at a temperature of from 38 degrees to 48 degrees F. and were preserved with our stock preservative—one part corrosive sublimate and three parts potassium bichromate. Fifty per cent. 9 gram Babcock bottles were used in testing. The following table will show results obtained:

Patron No. 1.	Aliquot Sample.		Ounce Sample.	
	% fat.	Lbs. fat delivered.	% fat.	Lbs. fat delivered.
April	38.25	56.418	38.25	56.418
May	38.5	94.325	38	93.1
June	40.5	89.91	41.5	92.13
July	39.5	76.432	40	77.4
Aug	32.5	68.9	32.5	68.9
Sept	32	75.04	33	77.385
Averages and totals	36.87	461.025	37.21	456.333

Patron No. 2.	Aliquot Sample.		Ounce Sample.	
	% fat.	Lbs. fat delivered.	% fat.	Ounce Sample.
May	29.25	100.181	30.5	104.462
June	28.5	125.4	29	127.6
July	23.75	103.075	23.5	101.99
Aug.,	24.5	115.885	24	113.52
Sept	25.5	109.777	25.5	109.777
Averages and totals	26.3	554.318	26.5	557.349

Patron No. 3.	Aliquot Sample.		Ounce Sample.	
	% fat.	Lbs. fat delivered.	% fat.	Lbs. fat delivered.
May	30.25	53.7	30	54.147
June	27.25	94.148	28.25	97.603
July	28.5	82.08	27.5	79.2
Aug.	30	89.15	29	86.855
Sept	28	79.66	29	82.505
Averages and totals	28.8	398.738	28.75	400.310
Total lbs. fat credited three patrons	.....	461.025 554.318 398.738	....	465.333 557.349 400.310
		1414.081		1422.992 1414.081
			Difference.	8.911 lbs. fat

COMMENTS.

1. These results agree with those obtained last year, when we said "There did not seem to be any advantage in the aliquot method and it is considerable more labor."

2. The total difference in number of pounds of fat credited by the two methods for two patrons during five months, and one patron for six months, was 8.9 lbs. fat, on a delivery of over 1,400 lbs. fat. This may be considered as reasonably accurate in creamery work, and indicates that a uniform quantity in sampling cream for composite tests, under the conditions given, will give patrons credit for the fat delivered in their cream.

METHODS OF CORKING COMPOSITE CREAM SAMPLE BOTTLES COMPARED.—ALSO OPEN SAMPLE BOTTLE.

From each of three individual cans of cream delivered at the dairy, ounce samples were taken and put into bottles having glass stoppers, wood stoppers, cork stoppers, paper milk bottle caps, and also into a bottle left open. A set of five bottles was used for each patron. Stock preservative was added to each bottle before cream was placed in the complete sample bottles. They were held at ordinary room temperature ranging from 50° to 85°F. The bottles fitted with cork and wooden stoppers showed mould in a number of cases. The glass and paper stoppered samples were in the best condition. The paper caps were renewed each month. A short nail was pushed through the cap from the lower side which projected above for a handle to remove them. The samples in the open bottles were nearly always covered with a thick scum, chiefly of mould growth.

The table shows the differences in the tests or percentages of fat in each method of corking the composite sample bottles for three patrons during the season; also the results of leaving the composite sample bottle open, or without any stopper:—

PATRON NO. 1

Month	Glass Stopper		Wood Stopper		Cork Stopper		Paper Cap		Open Bottle	
	% fat	Lbs. fat	% fat	Lbs. fat	% fat	Lbs. fat	% fat	Lbs. fat	% fat	Lbs. fat
April	39	57.525	38.25	56.418	28.25	56.418	38.25	56.418	41.25	60.743
May	37.75	92.487	38	93.1	37	90.65	38	93.1	40	98
June	41	91.02	41	91.02	40.75	90.465	41	91.02	43	95.46
July	40	77.4	40.75	78.85	39	75.465	41	79.335	41	79.335
Aug	33.5	71.02	33.5	71.02	32.5	68.9	33	69.96	34.5	72.61
Sept	33.25	77.971	33	77.385	32.5	76.212	33.5	78.557	34	79.73
Totals		467.423		467.793		458.110		468.390		485.878

PATRON NO. 2

Month	Glass Stopper		Wood Stopper		Cork Stopper		Paper Cap		Open Bottle	
	% fat	Lbs. fat	% fat	Lbs. fat	% fat	Lbs. fat	% fat	Lbs. fat	% fat	Lbs. fat
May	30.5	104.462	30.75	105.318	30.25	103.610	31	106.175	32.5	111.312
June	29.25	128.7	30	132	29	127.6	29.25	128.7	30.75	139.7
July	23.5	101.99	23.75	103.075	23.5	101.99	23.5	101.99	24	104.16
Aug	23	108.79	23	108.79	23	108.79	23.75	112.337	24	113.52
Sept	25	107.625	25.5	109.777	24.5	105.472	25.25	108.701	26.25	113.006
Totals		551.567		558.960		547.462		557.903		581.698

PATRON NO. 3

Month	Glass Stopper		Wood Stopper		Cork Stopper		Paper Cap		Open Bottle	
	% fat	Lbs. fat	% fat	Lbs. fat	% fat	Lbs. fat	% fat	Lbs. fat	% fat	Lbs. fat
May.....	29	51.91	29.5	52.805	28.5	51.015	29	51.91	30.5	54.595
June.....	28.5	98.467	27.75	95.875	27	93.285	28	96.74	29	100.195
July.....	28.25	81.36	28.25	81.36	27	77.76	28	80.64	29.5	84.96
Aug.....	28	83.86	29.25	87.603	28	83.86	29	86.865	30.5	91.347
Sept.....	28.5	81.082	28	79.66	27.5	78.237	28.5	81.082	29	82.505
Totals.....	.....	396.679	.....	397.303	.....	384.157	.....	397.237	.....	413.602
Total Lbs. fat for 3 patrons for season.....	.....	1415.669	.....	1424.056	.....	1389.729	.....	1422.530	.....	1481.17

CONCLUSIONS.

The glass stoppered, wood stoppered, and paper cap stoppered composite samples gave similar results for all three patrons for the season. The cork stoppered samples were lower than the other three for the season, although there is little or no difference for some months. The open bottle samples gave results altogether too high and show very forcibly the need of keeping composite bottles tightly stoppered. In the case of these three patrons over 60 lbs. of fat too much would have been credited by leaving the composite sample bottles open during the season.

EFFECT OF TEMPERATURE ON MONTHLY COMPOSITE CREAM SAMPLES.

Two samples were taken from each delivery of cream delivered by three patrons in individual cans. One composite bottle was kept in an ordinary room ranging in temperature from 50° to 85°F. The other was kept in cold-storage at a temperature ranging from 38 °F. in April to 48°F. in September. The bottles were stoppered with corks. Our stock preservative (3 parts potassium bichromate, 1 part corrosive sublimate) was used. The small ounce dipper was used to take samples from the cans after it had been thoroughly stirred. The amount of sample at the end of the month was from one-half to two-thirds of a pint.

PATRON No. 1.

Month.	Sample at Ordinary Room Temperature.			Sample held in Cold-storage.		
	Per cent. Fat.	Lbs. Fat.	Condition of Sample.	Per cent. Fat.	Lbs. Fat.	Condition of Sample.
April.....	38.25	56.418	Good.	38.25	56.418	Good.
May.....	37.	90.65	Some mould.	38.	93.1	Good.
June.....	40.75	90.465	Spots of mould.	41.5	92.13	Good.
July.....	39.	75.465	Some Mould.	40.	77.4	Good.
August.....	32.5	68.9	Spots of mould.	32.5	68.9	Good.
September....	32.5	76.212	Good.	33.	77.385	Good.
Totals		458.110	.....	.....	465.333	

PATRON No. 2.

Month.	Samples at Ordinary Room Temperature.			Samples held in Cold-storage.		
	Per cent. Fat.	Lbs. Fat.	Condition of Sample.	Per cent. Fat.	Lbs. Fat.	Conditions of Sample.
May.....	30.25	103.610	Thick cream; mould spots.	30.5	104.462	Good.
June.....	29.	127.6	Whey separation, mould spots,	29.	127.6	Good.
July.....	23.5	101.99	Small amount of mould.	23.5	101.99	Good.
August	23.	108.79	Mould spots.	24.	113.52	Good.
September....	24.5	105.472	Good.	25.5	109.777	Good.
Totals		547.462	.....	.....	557.349	

PATRON No. 3.

Month.	Sample at ordinary Room Temperature.			Sample held in cold-storage.		
	% fat.	Lbs. fat.	Condition of sample	% fat.	Lbs. fat.	Condition of sample.
May.....	28.5	51.015	Spots of mould.	30.	53.7	Good.
June	27.	93.285	Whey separation, mould spots	28.25	97.603	Whey separation.
July.....	27.	77.76	Small amount mould.	27.5	79.2	Good.
Aug	28.	83.86	Spots of mould.	29.	86.855	Good.
Sept	27.5	78.237	Good.	29.	82.505	Good.
Total....	.....	384.157		.....	399.863	

Total pounds of fat credited three patrons..	458.110	465.333
	547.462	557.349
	384.157	399.863
Grand total.....	1389.729	1422.545
	1422.545	
	1389.729	

Difference.... 32.816 lbs. more fat credited by keeping sample bottles in cold-storage as compared with keeping them at ordinary room temperature.

COMMENTS.

1. The samples kept in cold-storage were in better condition at the end of one month than were those kept at room temperatures. The composite samples kept in the ordinary room were frequently mouldy.

2. The samples kept in cold-storage frequently tested a higher percentage of fat than did those kept at room temperature. This resulted in an increased number of pounds of fat which would have been credited under these conditions, amounting in the case of these three patrons to 32.8 lbs., or, a little over 2 per cent. during five months. These results are somewhat different from what is usually expected, as samples kept at a higher temperature are supposed to lose some moisture by evaporation, consequently to test higher. The reverse of this was obtained in these cases. The composite samples kept at a comparatively low temperature for a

month were in better condition, as a rule, than were those kept at higher temperatures, consequently more accurate sampling would be possible and more even-handed justice likely to be given to the patrons concerned.

Comparison of Daily Testing with Composite Weekly Testing, Semi-Monthly Testing and Monthly Testing.

To make this experiment we selected three patrons delivering their cream in individual cans. We tested each delivery immediately after receiving it, and also took composite samples for weekly, semi-monthly, and monthly tests. These samples were kept in cork stoppered bottles in a cold storage ranging in temperature from 38° to 48°F., and were preserved with our stock preservative composed of three parts of potassium bichromate and one part mercuric bichloride. The ounce dipper was used in making samples. In testing these samples, nine gram Babcock bottles graduated to read to 50 per cent. fat were used. About 9 c.c. of water was added to the sample before placing the sulphuric acid in the cream. The following table will show the results obtained:—

Patron No. 1.

Month.	Lbs. Cream delivered.	Lbs. Fat by Daily Test.	Lbs. Fat by Weekly Test.	Lbs. Fat by Semi-monthly Test.	Lbs. Fat by Monthly Test.
April	147.5	56.992	56.403	56.787	56.418
May	245.	93.77	93.31	91.015	93.1
June	222.	89.882	90.435	89.127	92.13
July	193.5	76.671	76.791	76.094	77.4
August	212.	69.141	69.629	67.317	68.9
September	234.5	78.397	77.6	76.555	77.385
Totals	1,254.5	464.853	464.168	456.895	465.333

Patron No. 2

Month.	Lbs. Cream delivered.	Lbs. Fat by Daily Test.	Lbs. Fat by Weekly Test.	Lbs. Fat by Semi-monthly.	Lbs. Fat by Monthly Test.
May	342.5	100.278	100.36	101.305	104.46
June	440.	125.979	128.324	126.527	127.6
July	434.	101.356	101.954	101.78	101.99
August	473.	109.895	107.147	108.577	113.52
September	430.	107.904	108,569	107.72	109.777
Totals	2,119.5	545.412	546.354	545.909	557.347

Patron No. 3.

Month.	Lbs. Cream delivered.	Lbs. Fat by Daily Test.	Lbs. Fat by Weekly Test.	Lbs. Fat by Semi-monthly Test.	Lbs. Fat by Monthly Test.
May	179.	52.393	53.38	53.82	53.7
June	345.5	94.559	95.925	96.672	97.603
July	288.	80.679	80.866	81.98	79.2
August	299.5	84.873	86.854	84.012	86.855
September	284.5	81.745	82.075	79.977	82.505
Totals	1,396.5	394.149	399.100	396.461	399.863

TOTALS.

1,254.5	464.853	464.168	456.895	456.333
2,119.5	545.412	546.354	545.909	557.347
1,396.5	394.149	399.1	396.461	399.863
4,770.5	1,404.414	1,409.622	1,399.265	1,422.543

COMMENTS.

These results agree fairly well with those obtained last year and indicate that weekly, semi-monthly, and monthly testing on the composite plan, will credit patrons with approximately correct weights of fat delivered as compared with testing each and every delivery of cream to the creamery. On nearly 5,000 lbs. of cream, delivered by three patrons during the season, the difference in the number of pounds of fat credited by daily testing as compared with weekly and semi-monthly composite tests, was a little over five pounds—in the one case too high—in the other too low. In the case of the monthly composite tests the difference was 18 lbs. fat too much. This, however, on over 1,400 lbs. of fat, is a difference of about one and one-third per cent., which may be considered within the limits of error. Last year the results with the monthly composite samples were about 12 lbs. less on 1,500 lbs. fat as compared with the results from daily tests. The advantage of monthly and semi-monthly testing on the composite plan, as compared with testing each delivery, is the saving in labor and expense of testing. However, some of our creameries follow the plan of testing each lot of cream received and report the result at once to the patron. It is claimed that this promotes satisfaction among patrons, and in the long run pays better than composite sampling, and testing once or twice a month.

A COMPARISON OF THE WEIGHTS OF CREAM CONTAINING DIFFERENT PERCENTAGES OF FAT AND THE TEST OF EACH OF TWELVE BOTTLES ON THREE DIFFERENT CREAM SCALES.

The weight of cream in these tests was secured as follows: First, the bottles were weighed dry in a fine balance and the weights noted; then they were placed in a cream scale and the cream weighed in the usual way by balancing on the scale beam for nine grams; then the bottle and cream it contained was weighed again, on the fine balance. The difference between the combined weight of the cream and the bottle and the weight of the dry bottle gives the actual weight of the cream in the bottle. Nine gram cream Babcock bottles graduated to read to 50 per cent. were used in these tests. About 9 c.c. of water was added to each bottle before adding the acid when making the test.

RESULTS WITH FAIRBANKS SCALE.—FIVE TESTS.

No. of Bottle	Wght. cream in grams.	% fat	Wght. cream in grams.	% fat	Wght. cream in grams.	% fat	Wght. cream in grams.	% fat	Wght. cream in grams.	% fat
1	9.1	16.25	9.02	22.5	9.12	21.5	9.1	39.75	9.025	49.5
2	8.895	16.	9.	22.5	9.07	21.5	9.06	39.75	9.045	49.5
3	9.055	16.	8.96	22.5	8.98	21.25	8.99	39.5	9.02	49.5
4	9.	16.	8.975	22.5	9.06	21.5	8.98	39.75	8.985	49.25
5	8.995	16.	9.06	22.5	9.03	21.5	9.	39.5	9.01	49.25
6	8.995	16.	8.99	22.5	8.95	21.25	9.01	39.5	8.99	49.
7	9.1	16.25	9.31	23.	9.16	22.	9.14	40.	9.24	50.
8	9.065	16.	9.03	22.5	8.98	21.75	9.11	40.	8.96	49.
9	9.	16.	9.02	22.5	9.01	21.25	9.06	40.	9.02	49.5
10	8.96	16.	8.91	22.25	9.05	21.5	8.99	39.25	8.98	49.
11	9.07	16.	9.065	22.5	8.87	21.	9.05	39.75	8.995	49.25
12	8.94	16.	8.96	22.25	8.985	21.75	9.035	39.5	8.955	49.

RESULTS WITH TORSION SCALE.—FIVE TESTS.

No. of bottle.	Wght. of cream in grams	% fat.	Wght. of cream in grams	% fat.	Wght. of cream in grams	% fat.	Wght. of cream in grams	% fat.	Wght. of cream in grams	% fat.
1	9.08	17.75	9.13	21.25	9.165	28.25	9.105	35.	9.23	41.25
2	9.09	17.75	9.02	21.25	9.005	28.	9.115	35.25	9.01	41.
3	8.85	17.25	8.8	20.75	8.91	27.75	8.85	34.5	8.87	40.25
4	9.01	17.5	9.05	21.25	9.04	28.	9.02	35.	9.01	41.
5	9.1	17.75	9.145	21.25	8.955	28.	9.06	35.	8.985	41.
6	8.91	17.25	8.89	21.	9.055	28.	8.885	34.5	8.995	40.75
7	9.14	17.75	9.16	21.25	9.305	29.	9.11	35.	9.12	41.25
8	9.05	17.5	9.13	21.25	8.93	27.75	8.99	35.	9.06	41.
9	8.83	17.25	9.1	21.25	9.14	28.25	9.1	35.25	9.04	41.25
10	8.85	17.25	8.83	20.75	8.92	27.75	8.93	34.5	8.84	40.25
11	9.05	17.5	9.02	21.	9.05	28.	8.945	34.75	9.01	41.
12	8.93	17.25	9.02	21.25	8.93	27.75	8.96	34.75	9.065	41.

RESULTS WITH THE TROEMNER SCALE OF PHILADELPHIA.—FOUR TESTS.

No. of bottle.	Wght. of cream in grams	% fat.	Wght. of cream in grams	% fat.	Wght. of cream in grams	% fat.	Wght. of cream in grams	% fat.
1	9.015	17.5	9.035	21.5	8.97	33.75	9.02	37.75
2	9.04	17.5	8.98	21.5	9.05	34.5	9.01	37.75
3	9.005	17.5	9.03	21.75	8.95	34.5	8.985	37.75
4	9.05	17.5	9.05	21.75	9.015	34.5	9.00	37.5
5	8.94	17.5	8.945	21.5	8.96	34.	8.98	37.75
6	9.035	17.5	8.985	21.5	9.01	34.5	8.97	37.75
7	9.07	17.5	8.93	21.	9.04	34.75	9.09	38.25
8	9.05	17.5	8.95	21.5	9.115	35.	9.08	38.
9	9.01	17.5	8.96	21.5	8.905	34.25	9.005	38.
10	8.985	17.5	8.95	21.25	9.02	34.25	8.93	37.5
11	9.03	17.5	9.04	21.75	8.985	34.5	9.05	38.25
12	8.995	17.5	9.01	21.75	9.02	34.5	8.98	37.75

Comments.

1. In the case of the Fairbanks scale it will be noticed that the seventh bottle gave results too high with all five lots of cream tested. The other bottles gave fairly uniform results with all bottles.

2. The other two balances or scales gave fairly uniform results with each of the twelve bottles. So long as the extreme variation in the reading of the percentage of fat is not more than one-half of one per cent., it may be considered as within the "limits of error" when testing cream. There are a few cases of .75 per cent. variation in readings, which is rather more than we should allow in an accurate cream scale. On the whole, the tests of this year agree with those reported on last year, of which we said: "These results indicate that a sample of cream will likely be tested accurately, or at least within about .2 per cent. of accuracy, no matter what the number of the bottle as weighed on a twelve bottle cream scale." The variations are somewhat wider in 1912, as compared with the results of 1911.

The Use of Formalin as a Preservative in Composite Milk and Cream Samples.

The largest amount used was 1 c.c. (about twenty drops) and the least amount was ¼ c.c., or five drops. The following table shows the results with milk. Samples were kept at ordinary room temperature for one month:—

Date.	Quantity of Formalin.	Quantity of Milk in Bottle,	Per cent. Fat.	Remarks,
April	½ c.c.	½ pint	3.6	Sample good; clear reading.
"	1 c.c.	½ pint	3.6	Sample good; clear reading.
"	5 drops	½ pint	.....	Sample sour and curdled.
"	1 c.c.	½ pint	.....	Small amount of mould on sample. Test good.
May	½ c.c.	1 pint	3.6	Clear test. Sample in good condition.
"	1 c.c.	1 pint	3.6	Clear test. Spots of mould on sample.
June	½ c.c.	1 pint	3.2	Clear test, Sample in good condition.
"	1 c.c.	1 pint	3.3	Small specks of curd in fat column. Sample in good condition.
August,...	5 drops	1 pint	.....	Sample sour and curdled.
"	½ c.c.	1 pint	3.4	Clear reading; good condition.
"	1 c.c.	1 pint	3.4	Small amount of curd in fat column. Sample in good condition.

TABLE SHOWING THE RESULTS WITH CREAM—SAMPLES HELD AT ORDINARY ROOM TEMPERATURE FOR ONE MONTH.

Date.	Volume of formalin used.	Volume of cream in bottle.	% fat in cream.	Babcock cream bottle used for test.	Remarks.
April.....	½ c.c.	½ pint	30.25	9 gram	Sample good; reading clear.
"	½ c.c.	½ "	30.5	18 "	" " considerable curdy matter in reading.
"	1 c.c.	½ "	30.25	9 "	Sample good; small amount of curdy matter in reading.
"	1 c.c.	½ "	.....	18 "	17.5 c.c. acid used. Could not be read on account of curdy matter.
May.....	½ c.c.	1 "	29.5	9 "	Clear reading; mould on sample; whey separation
"	1 c.c.	1 "	29.5	9 "	Curdy reading; spots of mould on sample; whey separation.
June	½ c.c.	1 "	31.	9 "	Good test; sample in good condition.
"	½ c.c.	1 "	31.	18 "	Test clear; sample good.
"	1 c.c.	1 "	31.	9 "	Good test; sample all right.
"	1 c.c.	1 "	31.	18 "	17.5 c.c. acid used, test not good. 20 c.c. acid used, test clear.
Aug.....	¼ c.c.	1 "	.....	9 "	Test clear, sample fair.
"	¼ c.c.	1 "	.....	18 "	Not very good test.
"	½ c.c.	1 "	.....	9 "	Reading clear; sample good.
"	½ c.c.	1 "	.....	18 "	Curd in reading.
"	1 c.c.	1 "	.....	9 "	Small amount of curd at bottom of fat column.
"	1 c.c.	1 "	.....	18 "	Clear reading when 20 to 21 c.c. sulphuric acid was used;

The same samples were tested in both 9 gram and 18 gram Babcock bottles. The 9 gram samples had an equal amount of water added and then 17.5 c.c. of sulphuric acid. The 9 gram samples gave good readings except in a few cases where 1 c.c. of formalin was used. In the 18 gram samples, 1 c.c. of formalin always gave curdy readings when 17.5 c.c. of sulphuric acid were used, but when 20 c.c. or 21 c.c. of acid were used the reading was much better.

CONCLUSION.

So far as these tests indicate results, they show that about one-half a c.c. of formalin will preserve a pint sample of milk or cream in good condition for testing for a month. When 1 c.c. of formalin was used the tests were not satisfactory unless an extra volume of sulphuric acid was used (20 and 21 c.c. instead of 17.5 c.c.).

ORDINARY CANS VS. WOODEN JACKETED CANS FOR COLLECTING CREAM.

This is a continuation of the work reported on last year, to note the difference, if any, in the condition of the cream on arrival at the creamery, when delivered in an ordinary milk can, and in a wooden-jacketed can.

Date	Cream in Ordinary Can			Cream in Jacketed Can			Remarks
	Lbs. Cream	Temp. on arrival at creamery	% acidity	Lbs. Cream	Temp. on arrival at creamery	% acidity	
May 7	169	67°F	.42	166	61°F	.42	Warm weather
" 14	214	54°	.38	200	51°	.37	Very cold
" 21	188	50°	.33	164	52°	.29	Cold, wet day
" 30	181	65°	.37	150	60°	.36	Warm
June 6	196	59°	.47	194	57°	.42	
" 13	153.5	62°	.46	150	59°	.45	Cool
" 20	161	66°	.52	166	62°	.5	
" 27	178	67°	.54	153.5	61°	.51	
July 11	187	74°	.59	161	68°	.58	
" 18	155	69°	.52	135	65°	.52	Cool
Aug. 15	164	67°	.57	155	64°	.56	
Average	177	63.6°	.47	163.1	60°	.452	

Comments.

1. The greatest differences in the cream on arrival between that in a ordinary can and that in a jacketed can, was six degrees in temperature and .0 per cent. acidity in favor of the cream in a jacketed can. The average differenc was 3.6 degrees in temperature and .022 per cent. acidity in favor of the crear collected in a jacketed can.

2. As a rule, there was not sufficient decrease in the acidity of the cream i the jacketed can to pay for the extra expense of these cans as compared with mil cans, to say nothing of extra load in hauling and more inconvenience in handling It will be noted in the table that on May 21st, the temperature of the cream in th ordinary can was lower than that in the jacketed can. This was probably caused b the rain and low temperature of the air affecting the contents of the milk can mor than they did the contents of the jacketed can.

3. From the two years' tests it would seem to be doubtful if it pays to hav cream in the wooden jacketed cans, except in very hot weather. More tests durin hot weather are needed before the question can be settled.

Cost of Pasteurizing Cream, 1912.

Last year we reported the results of tests made as to the cost of pasteurizin cream for buttermaking. The averages of these tests was .032c. per lb. butte This year the tests showed a cost of .0341 c. per lb. or 3.41 c. per 100 lbs. of butte All the experiments were conducted at the Guelph creamery this year. We are in debted to Messrs. Stratton and Taylor of the Guelph Creamery Co., for the co-operation in the work during the past two seasons.

The cream was handled as follows: it was first emptied into a large receivin vat, from there it passed through a Reid Pasteurizer having a capacity of 6,500 lbs. per hour, which delivered it over a Lister circular cooler of 380 gals. per hour capacity. As it ran from the cooler it was pumped into two "Century" vats of

about 2,500 lbs. capacity each, where it was held over night. A 35 h.p. return tubular boiler was used to supply steam for pasteurizing. For power, a motor was used at a cost of 2½ cents per kilowatt-hour in addition to 1⅛ cents per K. W. H. for current used. Water was used for cooling, costing 10c. per 1,000 gallons. The coal used for firing cost, $4.28 per ton.

——	July 3rd.	July 10th.	July 17th.	Aug. 7th.	Aug. 14th.
Lbs. of cream	4,480	2,100	3,900	2,350	2,350
Per cent. fat in cream	29	29	30	30	30.5
Per cent. acidity of cream	.55	.58	.61	.52	.51
Temp. of cream at start	75–77 F	75–77 F	66–70	65–69	75
Temp. of cream at finish	58 F	58	57	57	62
Time running	2 hrs. 10 min.	1 hr. 15 min.	1 hr. 35 min.	1 hr. 12 min.	54 min.
Pasteurizing temperature	180 F	180 F	190 F	190 F	185 F
Temp. of cooling water	50 F	52 F	52 F	51 F	52 F
Gallons of water used	2,369	1,550	1,786	1,370	1,100
Lbs. of coal used	60	52	100	55	50
K.W.H. of power used	3.3	2	2.2	2	1.2
Lbs. of butter made	1,559	731	1,404	826	868
Total cost of pasteurizing	45.85c	31.99c	45.7c	30.72c	25.7c
Cost per lb. of butter	.0294c	.042c	.0326c	.0371c	.0296c
No. of vats	2	1	2	1	1

Conclusions.

The average cost of pasteurizing the cream for the manufacture of 100 lbs. of butter during the tests of the seasons 1911 and 1912, is 3.3 cents. This cost is not excessive and should not prevent any buttermaker adopting the system of pasteurization, where there is sufficient steam boiler capacity, a suitable heater, an economical cooler, and a plentiful supply of cold water for cooling.

Tests of a Combined Pasteurizer and Cream Vat.

In addition to the cost for fuel, for heating, and the cost of water or ice for cooling, the labor cost is quite an important item in pasteurizing milk and cream. Several new machines have been put on the market recently to reduce the cost of labor in heating and cooling milk and cream. Among these, a combined heater, cooler, and cream vat, known as "The Wizard" claims to reduce the cost very materially. We have used one of these vats during the past season for pasteurizing both milk and cream, with very satisfactorily results.

A number of persons interested have asked for information as to the length of time required to heat and cool cream. Tests were made to get some data on this point. The vat is constructed so that ice may be packed in the compartment at one end, then water which has been cooled with the ice is pumped through the coils for cooling.

The table shows the main points observed in the tests.

CAPACITY OF VAT, 100 GALLONS.

	Dates of Experiments.		
	July 22.	July 25.	Aug. 1st.
Lbs. cream pasteurized	1,003	837	860
Acidity of cream when heated	.48%	.48%	.53%
% fat in cream	30	32	31.5
Temp. cream when received	65°F	66°	64°
Pasteurizing temperature	160°F	160°	160°
Time heating	25 min.	13 min.	32 min.
Time held at Past. temp	20 min.	20 min.	20 min.
Time to cool with water	1 hour	33 min.	1 hour.
Temp. of water	49 F	56°	48°
Temp. cooled to with water	60°F	75°	54°
Lbs. ice used	150	225	150
Temp. cooled to with ice	46°F	49°	44°
Temp. of cream at 6 p.m	46°	49°	44°
Temp. cream next morning 7 a.m	51°	58°	51°
Lbs. culture added	56	50	75
Per cent acidity next morning	.55	.55	.55

STIRRING MILK WHILE COOLING *vs.* NOT STIRRING

This Can not Stirred.			Temp. of water 44°F. About 150 lbs. of Milk in each Can.	This Can Stirred during the time of Cooling.
Outside of can.	6 inch from outside.	Centre.		
.....	.....	95	Temp. of milk at the time of placing in water....	95°
86°	86°	86°	Temp. of milk 10 minutes later.....	78°
83°	83°	83°	" " 20 "	71°
77°	78°	78°	" " 30 "	64°
70°	70°	70°	" " 40 "	58°
65°	66°	66°	" " 1 hour later.....	54°
.....	.....	44°	Next morning.....	44°
Remarks				Remarks
Next morning slight amount of cream and dry matter formed on the milk. Acidity 16%.			Unless the bulb of the thermometer was held against the side of the can there was little or no difference in the temperature of the milk at any point. Experiments made evening of May 30th.	Next morning milk in nice condition. Acidity .145%.
.....	.....	92°	Temp. of milk when placed in water.....	92° at 5.30 p.m.
86°	86°	86°	Temp. of milk at 5.40 p.m.....	84°
82°	82°	82°	" " 5.50 "	78°
78°	80°	80°	" " 6.00 "	72°
76°	76°	76°	" " 6.10 "	70°
72°	72°	72°	" " 6.20 "	68°
Acidity .145% next a.m.			Both 60° in the morning	Acidity .14% next a.m.

No apparent difference in the condition of milk. The experiment was conducted in tin cans, 14½ inches in diameter, filled to the level of the water, which was at a temperature of 60°F. Experiment made evening of July 10th.

Comments.

1. There was little or no difference in the temperature of the milk in the cans not stirred, comparing milk in the centre of the can with that near the outside, or six inches from the outside.

2. The milk cooled more rapidly when stirred, and had slightly less acid the following morning, but there was very little difference in the general condition of the two lots. Under ordinary conditions in the case of milk for cheese-making it would seem as if stirring were not necessary, except where more rapid cooling is desired.

BUTTERMAKING.

The Effect of Neutralizers of Acidity in Cream for Buttermaking.

Lime-water and milk-lime were used as neutralizers in sour cream for buttermaking during the season of 1912. Last year we reported on the effect of lime and also upon the effects of baking and washing soda. These latter was not satisfactory for the purpose. To determine the effect of adding lime-water as a neutralizer of the acid in sour cream, we conducted a series of three experiments, each containing three churnings, as follows: In one lot the sour cream was pasteurized and ripened in the ordinary way; to another lot the lime-water was added *before* pasteurizing; and to the third lot the lime-water was added *after* pasteurizing. All pasteurizing was done in the "Wizard Agitator." The butter was scored at the end of one week and again at the end of one month. These experiments were made during July and August. The following are the averages of three experiments:—

	No neutralizer added.	Lime-water added before pasteurizing.	Lime-water added after pasteurizing.
Average lbs. of cream churned	314	344	364
Per cent, fat in cream	28.5	24.3	24.1
Per cent, acidity	.483	.483	.483
Lbs, of lime-water added	.....	53	53
Per cent. acidity after adding lime-water	.....	.463	.336
Per cent, acidity at churning	.51	.43	.43
Churning temperature	53.6°	53.6°	53.6°
Temperature of wash-water	54.6°	54.6°	54.6°
Time churning in minutes	20	36.6	33.6
Lbs, of butter	106	99.6	105
Per cent. moisture in butter	13.93	14	13.83
Per cent. salt in butter	3.76	3.75	4.01
Average per cent. fat in buttermilk	.51	.346	.32
Lbs. of culture added to cream	27	25	27
Pasteurizing temperature	160°	160°	160°
Time held at pasteurizing temperature	17 min.	17 min.	17 min.
Average Scores of the Butter:			
Flavor (50)	44.1	43.3	43.1
Grain (20)	18.2	18.4	18.4
Colour (15)	14.6	14.7	14.7
Salt (10)	10	9.9	9.9
Package (5)	5	5	5
Total (100)	91.9	91.3	91.1

In all cases where the lime water was added before pasteurizing, the average acidity of the cream after pasteurizing was .363 per cent, having been reduced from .463 by heating.

When using lime-water (a saturated solution) it was found that the amount of lime-water required to neutralize the acid in the cream was too large, consequently lowering too much the percentage of fat in the cream for efficient churning. To overcome this, there was prepared a more concentrated form of lime, by slaking fresh lime with three times its weight of water and afterwards straining the lime to remove lumps. This milk-lime being stronger, required only a small quantity to do the neutralizing. The following are the results of a similar series of experiments to those made with lime-water:—

——	No neutralizer.	Milk-lime added before pasteurizing.	Milk-lime added after pasteurizing.
Average lbs. of cream	307	208	303
Per cent. fat in cream	28.5	28.8	29
Per cent. acidity in cream	.51	.51	.51
Lbs. of milk-lime added to cream		1.66	1.66
Per cent. acidity after adding milk-lime		.2	.193
Per cent. acidity of cream at time of churning	.53	.41	.37
Churning temperature	52°	52°	52°
Temperature of wash-water	54.6°	54.6°	54.6°
Time churning in minutes	20	29	23
Lbs. of butter	104.	101.6	103.
Per cent. moisture in butter	14.03	13.93	13.96
Per cent. salt in butter	3.71	4.13	4.01
Per cent. fat in buttermilk	.66	.23	.393
Lbs. culture added to cream	25	25	25
Pasteurizing temperature	160°	160°	160°
Time held at past. temperature	10	10	10
Average Scores of the Butter:			
Flavor (50)	39.83	43.16	43.3
Grain (20)	18.75	18.5	18.75
Color (15)	14.51	14.51	14.5
Salt (10)	9.9	9.9	9.9
Package (5)	5	5	5
Total (100)	87.99	91.07	91.45

The average percentage of acidity in the cream after pasteurizing in the lots where the lime-milk was added before pasteurizing was .15.

Comments.

1. The lime-water, owing to its weakness in neutralizing the acidity of cream, is not a satsfactory "neutralizer."

2. The milk-lime, owing to its concentrated nature, proved more satisfactory for the purpose. The butter scored about three points higher by adding milk-lime to the cream before pasteurizing, and three-and-a-half points higher by adding the milk-lime after pasteurization, as compared with the scores of butters from similar lots of cream which were not neutralized. In no case, however, was the cream of very high acidity at the time of adding the neutralizer. The average percentage of acid in the cream at this time was about .5.

3. It would seem to be more reasonable and less expensive to prevent the development of too much acid in the cream by keeping it cold and delivering oftener, rather than trying to overcome the trouble of too much acid after its arrival at the creamery by the use of "neutralizers." This is a case where "an ounce of prevention is worth a pound of cure." However, in those cases where cream is delivered at the creamery in a very sour condition, the addition of milk-lime would seem to be a practicable method of overcoming the bad effects of too much acid in the cream, and a better quality of butter is likely to result by so doing.

Raw *vs.* Pasteurized Cream for Buttermaking.

The cream was divided into two lots immediately after receiving it. One lot was pasteurized and cooled; the other, cooled as soon as possible without heating. About eight per cent. culture was added to each lot. The cream was received about three o'clock in the afternoon and was churned next morning after being held over night at churning temperature. The lots which were pasteurized were held for different lengths of time at different temperatures as indicated in the table. The butter was salted at the rate of 6 pounds of salt per 100 lbs. of fat. All samples were scored when about one week old and again at the end of four or five weeks having been kept in the meantime in an ice cold storage at a temperature of about 40°F.

——	No. 1 Average of four experiments.		No. 2 Aver. of three experiments.		No. 3 Aver. of three experiments.		No. 4. Aver. of three experiments.		No. 5. Aver. of three experiments.	
	Raw.	Past.	Raw.	Past.	Raw.	Past.	Raw.	Past.	Raw.	Past.
Lbs. of cream..	269	298	308.3	303	326.3	311.3	318.3	318	309.6	321
Per cent. fat in cream	30.1	31.2	29	30	30.1	30.8	29.3	30	28.1	28.5
Acidity of raw cream ..... %	.455	.455	.433	.433	.486	.486	.473	.473	.473	.473
Acidity of ripe cream .....%	.567	.51	.55	.5	.563	.523	.573	.516	.573	.53
Churning temp.	50.7°	50.7°	51°	50.6°	54.3°	53.6°	52.6°	53°	53.3°	53.3°
Temperature of wash-water..	54.5°	54.5°	54°	53.6°	55.3°	55.3°	54.6°	54.6°	54°	54.3°
Lbs. of butter..	96.5	110.2	108.6	108.6	118.6	114.3	114.3	115.3	105	106
Fat in butter-milk .....%	.115	.367	.12	.156	.22	.453	.123	.266	.17	.36
Moisture in butter .....%	14.35	14.02	14.46	13.66	14.23	14.06	14.6	14.1	14.56	13.96
Per cent salt in butter	3.41	4.18	3.66	3.95	3.45	3.65	3.16	3.63	3.38	3.85
Pasteurizing temperature..	.....	180°	.....	180°	.....	160°	.....	140°	.....	140°
Time held in minutes	.....	30	.....	10	.....	20	.....	30	.....	10
Time churning in minutes ..	30	29.5	59	56	27.6	20.3	37.6	38.6	28.3	31.6
Per cent.overrun	19.65	18.47	21.43	19.8	19.56	18.4	22.4	20.9	20.9	18.6

AVERAGE SCORES OF THE BUTTER

No. of Exp.	Flavor (50)	Grain (20)	Color (15)	Salt (10)	Package (5)	Total (100)
1	43.18	18.62	14.43	9.75	5	90.98
	42.62	18.5	14.5	9.75	5	90.37
2	45.16	18.83	14.5	9.8	5	93.29
	44.66	18.83	14.33	9.83	5	92.65
3	42.33	18.5	14.58	10	5	90.41
	42	18.33	14.41	9.91	5	89.65
4	44.66	18.66	14.85	9.91	5	93.08
	44	18.58	14.66	10	5	92.24
5	43.16	18.66	14.58	9.91	5	91.31
	44.33	18.83	14.5	10	5	92.66

CONCLUSIONS.

1. There was a greater loss of fat in the buttermilk from the lots pasteurized.

2. The "overrun" or yield of butter was less from the lots of cream pasteurized.

3. There was not much difference in the quality of the butter as indicated by the scores. This is different from the results got in previous experiments, and is accounted for by the relatively high scores given to the raw lots when fresh.

RELATION OF CREAM ACIDITY AT THE TIME OF PASTEURIZATION TO LOSS OF FAT IN THE BUTTERMILK AND THE QUALITY OF THE BUTTER.

In order to determine to what extent the acidity of the cream pasteurized affected the percentage of fat which is lost in the buttermilk, we conducted a series of experiments along the following lines:

The cream, as received, was divided into two lots—No. 1 lot was pasteurized at 140° or 180°F. and held for 10 to 30 minutes, then it was cooled and culture added. The cream was churned the following morning. The other lot was held over until the following afternoon under such conditions as would develop a higher acidity, and then it was treated the same as No. 1. The Wizard Agitator was used for pasteurizing and holding the cream at different temperatures and for different lengths of time. The butter was scored within a week after being made and again a month later. The butter was salted at the rate of 6 lbs. salt per 100 lbs. fat in the cream. The following table shows the results obtained:—

	No. 1. Pasteurized at 180 F. for 30 min. 2 Experiments.		No. 2. Pasteurized at 180 F. for 10 min. 3 Experiments.		No. 3. Pasteurized at 140 F. for 30 min. 3 Experiments.		No. 4. Pasteurized at 140 F. for 10 min. 3 Experiments.	
	Ordinary acidity.	High acidity.	Ordinary acidity.	High acidity.	Ordinary acidity.	High acidity.	Ordinary acidity.	High acidity.
Lbs. of cream	349	289.5	303	289	318	329.6	321	291
Per cent. fat	31.5	30.5	30	30.1	30	29	28.5	28.3
Acidity of raw cream %	.51	.68	.43	.7	.473	.696	.473	.67
Acidity of ripe cream %	.535	.65	.5	.653	.516	.64	.53	.61
Churning temp. deg.	50	50	50.3	51	53	52.6	53	52.6
Time churning in mins.	31	17	56	22.3	38.6	20.3	31.6	22.6
Temp. of wash water, deg	54.5	53.5	53.6	53.6	54.6	54	54.3	54
Lbs. of butter	130	104.5	108.6	103.6	115.3	115.3	108.6	98.6
Fat in buttermilk %	.445	.585	.156	.593	.266	.486	.36	.32
Moisture in butter %	14.45	14.45	13.6	14.7	14.1	15.23	13.96	13.66
Salt in butter %	4.45	4.27	3.95	3.96	3.63	3.83	3.85	4.51
Overrun %	18.25	18.3	19.8	18.8	20.9	20.7	18.6	19.7

AVERAGE SCORES OF BUTTER.

No.	Flavor. (50)	Grain. (20)	Color. (15)	Salt. (10)	Package. (5)	Total, (100)
1	43	18.5	14.5	9.87	5	90.87
	41.5	18.7	14.5	9.87	5	89.57
2	44.5	18.8	14.5	9.8	5	92.6
	39.66	18.66	14.33	9.8	5	87.45
3	44	18.58	14.66	10	5	92.24
	38	18.41	14.66	10	5	86.07
4	43	18.75	14.5	9.8	5	91.05
	38.66	18.66	14.58	9.8	5	86.7

COMMENTS.

1. As in 1911, an increase in the acidity of the cream at the time of pasteurizing caused an increased loss of fat in the buttermilk when the cream was churned. This is probably caused by increased coagulation of the caseous matter which entangles more of the fat globules and prevents their churning or massing in the form of butter.

2. In all four series, the cream pasteurized with the higher acidity produced butter which gave a lower average score as compared with butter made from similar cream pasteurized on arrival at the creamery when moderately sweet, although in no case was the cream delivered sweet. The difference in favor of early pasteurization of the cream was greater in the lots pasteurized at 140°, as compared with pasteurizing at 180°F. Early pasteurization and high temperature (180°F.) seemed to give more favorable results with high acid cream than did heating to a lower temperature (140°F.)

CONDITIONS AFFECTING THE SALT AND MOISTURE IN BUTTER.

This is a continuation of the experiments conducted last year on these points. The first series relates to the effects of dry and wet salt. These experiments were made with two churnings of the same kind of cream. The cream was pasteurized at 180°F. The two churnings were as nearly alike as possible until the salt was

added. Dry salt was added to one and wet salt to the other. The working was finished in the usual way. The salt was made quite moist by adding one part by weight of water to two parts of salt. The tap at the back of the churn was kept closed during working. The results given are the average of six churnings. In each lot the butter was salted at the rate of 6 lbs. salt to 100 lbs. fat in the cream.

—	Av. lbs. cream for each churning	Av. % fat in cream	Av. % acidity of raw cream	Av. % cream acidity before churning	Av. churning temp.	Av. temp. of wash water	Av. lbs. butter for each churning	Av. time churning, in minutes	Av. % fat in buttermilk	Av. % moisture in butter	Av. % salt in butter
Dry Salt.....	292	28.6	.33	.52	54.3°F	57°F	101	21.5	.156	14.41	3.35
Wet Salt.....	268	28.6	.33	.52	54.8°	57°	93.3	21.5	.11	14.3	2.98

Comments.

1. The salt which was added to the butter in a wet condition was better distributed and more in solution than was the dry salt lots at the time the butter was taken from the churn. The churn also contained more water after removal of the butter from the churn in the case of the lots salted wet, as compared with dry salting.

2. There was not much difference in the average percentage of moisture retained in the finished butter, whether salt at the rate of six per cent. was applied to the butter in a dry or in a wet condition.

3. The percentage of salt retained by the butter was slightly greater in the dry salt lots. Last year the wet salt lots contained most salt.

Butter in Small Granules vs. Large Lumps at Time of Salting.

To determine whether the size of the granules had any effect on the amount of salt the butter would retain, a series of twelve churnings were made, all of which were handled alike up to the time of washing the butter. Six of the churnings were over-churned in the wash water until the butter had massed into lumps the size of nuts and small apples. They were all drained for twenty minutes to one-half hour to allow the surplus water to escape. They were then salted at the rate of 6 lbs. of salt per 100 lbs. fat in the cream and were worked as nearly alike as possible, having the tap at the back of the churn closed. All cream was pasteurized at 176° to 180°F. The following table shows the average results from six churnings each, having the butter in small and large granules.

—	Lbs. cream.	% fat.	% acidity of raw cream.	% cream acidity before churning.	Churning temp.	Temp. wash-water.	Lbs. butter.	Time churning in minutes.	% fat in butter-milk.	% moisture in butter.	% salt in butter.
Small granules...	300	29.3	.346	.513	54°F.	58°F.	106	21.6	.188	14.24	3.62
Large granules...	294	29.3	.346	.513	54°	58°	104	22.1	.18	13.7	4.26

Comment.

The butter churned to about the size of wheat granules contained more moisture and less salt than did similar butters churned to lump size.

Cause of Grittiness in Butter.

At different times while scoring samples of butter from the various experiments, the comment was made by the scorer that the salt was "gritty" and the butter "mottled." On looking up the records of these butters we found that the percentage of salt was high—usually above 4 per cent., and the moisture content comparatively low, or not above the average. The question arose as to how much moisture was necessary in order to have the salt in a condition when it would not be "gritty," or in other words to have it all dissolved. In order to test this, saturated solutions were made of the salt we were using. These were tested with the silver nitrate test, and found to contain an average of 29.25 per cent. salt. From this data it is a simple calculation to find the percentage of salt which butter with different percentages of moisture could carry as brine, providing the brine was a saturated solution. If more salt was added, there was not enough moisture to dissolve it, consequently the salt would be retained in an undissolved or gritty condition. The table below, gives the per cent. of salt that butter with different percentages of moisture is capable of holding in a soluble condition using 29.25 as the percentage of salt soluble in water at 60°F.

Moisture in Butter.	Salt possible in dissolved state.	Moisture in Butter.	Salt possible in dissolved state.
%	%	%	%
13.5	3.94	14.8	4.32
13.6	3.97	14.9	4.35
13.7	4.	15.	4.38
13.8	4.03	15.1	4.41
13.9	4.07	15.2	4.44
14.	4.09	15.3	4.47
14.1	4.12	15.4	4.5
14.2	4.15	15.5	4.53
14.3	0.18	15.6	4.56
14.4	4.21	15.7	4.59
14.5	4.24	15.8	4.62
14.6	4.27	15.9	4.65
14.7	4.29	16.	4.68

Loss of Salt Applied to Butter Accounted For.

In order to account for the amount of salt which is not retained in the finished butter, four churnings were made in which the butter in the churn was not allowed to stand any length of time, but as soon as the water was fairly well drained the salt was added and the working was done with the tap closed. After the butter was removed from the churn the free water that was still left in the churn was collected and tested for salt. The butter was also tested for salt. In this way we were able to account for nearly all of the salt added to the churn. The salt which adhered to the worker was not collected. It is very difficult to prevent a certain amount of salt adhering to the worker but it is possible to remove the free water from the churn before salting by giving sufficient time to drain and this time should be about 20 or 30 minutes.

Lbs. salt added.	Lbs. salt in finished butter.	Lbs. salt in water left in the churn after working.	Total lbs. salt accounted for.	Lbs. salt unaccounted for but probably adhering to worker.
5.31	3.424	1.295	4.719	.591
4.98	3.45	.61	4.06	.920
4.29	3.156	1.048	4.204	.086
5.77	3.36	1.54	4.90	.870

Moisture and Salt in Butter at the End of 1, 2, and 3 Months.

To ascertain whether or not the moisture and salt varies in butter when kept for some time, and if so, to what extent, we held eight pound prints and three 28 lb. boxes of solids from different churnings. These were tested for moisture and salt content immediately on removing the butter from the churn and again after packing or printing. They were also tested at the end of one, two, and three months. In taking a sample from the prints, a slice about one-half inch in thickness was cut crosswise of the print. In taking samples from the solids a butter trier was used which went through the solid block of butter to the bottom of the box. The whole plug was taken for a sample. We found that triers of different shapes and sizes took samples giving different results in moisture content of butter. A difference of .4 per cent. to 1 per cent. was observed between samples taken with a large and small trier. The small trier seemed to squeeze the moisture out of the butter when sampling. The butter was held in a Hanrahan ice-cold storage at a temperature ranging from 38° to 45°F.

The table shows the main points observed in the experiments:

Prints.

Date.	Sample from Churn.		Sample after Printing.		Sample after One Month in Cold-storage.		After Two Months in Storage		After Three Months in Storage.	
	Per cent. Moisture.	Per cent. Salt.	Per cent. Moisture.	Per cent. Salt.	Per cent. Moisture.	Per cent. Salt.	Per cent. Moisture.	Per cent. Salt.	Per cent. Moisture.	Per cent. Salt.
April 19	13.1	4.1	13	3.5	12.2	3.2	12.4	3.27	12.2	3.15
" 24	13.7	3.1	14	3.2	13.9	2.7	13.9	3.25	14	2.85
May 8	14.1	2.66	13.6	3.2	13.6	3.2	13.4	2.8	13	2.9
June 7	14.3	4.4	14.1	4.33	14.2	4.3	13.6	4.2	13.9	4.15
" 7	14.4	3.2	14	2.9	12.8	2.6	13.2	2.65	13.2	2.8
" 24	15.2	3.5	14.7	3.05	13.9	3.3	14.6	3.3	14.4	3
" 24	14.3	3.6	13.8	3.05	13	3.1	13.6	3.2	13.2	3.05
" 24	14.6	3.5	13.5	3.33	14.2	3.5	13.2	3.25	13.2	2.9
Averages	14.21	3.5	13.83	3.32	13.47	3.23	13.48	3.36	13.38	3.10

SOLIDS.

Date.	Sample from Churn.		Sample after Packing in Box.		After One Month in Cold-storage.		After Two Months in Cold-storage.		After Three Months in Cold-storage.	
	Per cent. Moisture.	Per cent. Salt.	Per cent. Moisture.	Per cent. Salt.	Per cent. Moisture.	Per cent. Salt.	Per cent. Moisture.	Per cent. Salt.	Per cent. Moisture.	Per cent. Salt.
May 15.....	13.8	3.2	13.4	2.8	12.6	2.74	12.9	2.85	13.4	2.95
" 22.....	13.8	3.7	13.4	3.1	12.2	2.95	11.3	3.2	11.6	3.3
June 7.....	13.8	3.55	13.7	3.6	12.4	3.15	12.6	3.35	13.2	3.4
Averages ..	13.8	3.48	13.5	3.16	12.4	2.94	12.26	3.13	12.73	3.21

CONCLUSIONS.

1. Both prints and solids appeared to have less moisture and salt after printing and packing than immediately before printing and packing. Some moisture, and consequently some salt, is always lost in the process of printing and packing. The average differences in these tests were: .39 per cent. less moisture in prints; .3 per cent. in solids; the average percentages of salt were less by .18 and .28 respectively for prints and solids.

2. By the end of a month the average percentage of moisture in prints had decreased by .74 per cent. and the solids by 1.4 and remained at about these points during three months in cold storage. It is difficult to account for the solids losing more moisture than did the prints, unless it were caused by the trier expelling free moisture at the time of sampling.

3. The average percentages of salt in the butter tended to remain fairly constant from the time of packing until the last samples were taken at the end of three months—for prints, 3.32, 3.23, 3.36, and 3.10; solids, 3.16, 2.94, 3.13, and 3.21.

4. Both prints and solids lose moisture when in cold-storage, hence lose in weight, therefore, an extra weight of butter should be placed in both prints and solid packages which are held in cold storage.

H. H. DEAN.

PART IX.

THE PROFESSOR OF ANIMAL HUSBANDRY AND FARM SUPERINTENDENT.

To the President of the Ontario Agricultural College.

SIR,—I have the honor to submit herewith the report of my department for the year 1912.

PURCHASE OF LAND.

During the present year, one hundred and fifty acres of additional land has been added to the College property. The Farm department, however, has not benefited to the full extent of this purchase. Ten acres of the purchased land goes to the department of Pomology, and we have turned over to the Experimental department twenty-five acres of our best land adjacent to the farm buildings in exchange for part of the purchased property. The two farms which were purchased are not in the best condition, and some of the land is anything but first-class. It will require several years to bring this property into such a condition as we would like to have it.

FARM CROPS.

The crop of 1912 is much more satisfactory than that of 1911. The season was wet, and harvesting operations greatly delayed in consequence, but the crop is reasonably satisfactory. The winter wheat was rather badly winter-killed. Oats and barley were a good average crop, and the oats are of specially good quality, though in some cases slightly damaged by the weather. Potatoes were a heavy crop, but badly affected with rot. The mangels were sown somewhat late, owing to unfavorable weather, and in consequence were not up to our usual mark, but turnips were an exceedingly heavy crop. As a comparatively small proportion of the grain has been threshed, it is impossible to give even an approximate idea as to yields.

IMPROVEMENTS.

The main improvement this year is the building of a new dairy stable, which has been badly needed for a number of years. Unfortunately, however, the workmen were late starting, and at the time of writing the stable is not complete. When the building is completed, we hope to publish plans and descriptions.

THE DAIRY HERD.

Following is the record of the dairy herd for the past year, the cows being arranged in order of production of butter fat.

In the column denoting breed, A stands for Ayrshire, H for Holstein, J for Jersey, and G for grade.

The record is for the fiscal year, that is to say: from November 1st, 1911, to October 31st, 1912. This method of computing milk production does not do justice to the cows in all cases, but it is about the only practicable method under the circumstances.

REPORT OF DAIRY HERD, 1912.

Cow.	Breed.	Age Nov. 1st, 1911.	No. days milking.	Lbs. milk.	% fat in milk.	Lbs. fat in milk.	Lbs. butter adding ⅓ fat.	Value fat 27 cts. per lb.	Cost of feed.	Profit over cost of feed.
								$ c.	$ c.	$ c.
Boutsje	H	9	318	16,091	3.2	502.95	586.77	125 74	86 83	38 91
Molly Rue	H	3	366	11,530	3.3	381.47	445.05	95 37	71 74	23 63
Inka Mercedes	H	12	366	9,550	3.4	321.64	375.24	80 41	69 82	10 59
Blackie	G	9	280	9,235	3.44	318.07	371.08	79 51	68 61	10 90
Margaret Corn	H	6	312	8,787	3.6	314.42	366.82	78 60	69 80	8 80
Beauty of O.A.C.	H	7	300	10,690	2.9	310.16	361.85	77 54	72 46	5 08
No. 166	G	1	305	8,377	3.57	298.98	348.81	74 74	46 31	28 43
Molly De Kol	H	10	289	8,856	3.26	288.61	336.71	72 15	68 87	3 28
Tibbie	A	6	330	7,093	4.07	288.60	336.70	72 15	60 60	11 55
Toitilla	H	10	290	8,430	3.4	287.06	334.90	71 76	45 04	26 72
Mercena 2nd	H	1	305	9,307	2.98	276.92	323.07	69 23	46 31	22 92
Nancie	A	11	366	7,014	3.8	264.93	313.75	67 23	49 36	17 87
Nancie O.A.C.	A	2	362	6,812	3.9	264.53	308.62	66 13	48 31	17 82
Blend	G	1	286	6,790	3.9	259.95	303.28	64 99	41 97	23 02
Abby M. Net	H	5	285	6,826	3.8	258.38	301.44	64 59	63 09	1 50
Dolly	J	9	329	5,429	4.7	256.36	299.09	64 09	48 80	15 29
Aggie	J	10	335	4,994	5.12	255.97	298.63	63 99	48 80	15 19
Floss 5th	A	6	310	7,496	3.4	255.01	297.51	63 75	38 36	25 39
Queenie	J	13	284	5,054	4.8	245.40	286.30	61 35	55 80	5 55
Minnie O.A.C.	A	2	305	6,457	3.8	244.55	285.31	61 14	65 48	−4 34
Dainty O.A.C.	A	3	295	5,824	4.1	240.30	280.35	60 07	56 94	−3 13
Molly Neth	H	7	254	6,877	3.4	232.88	271.69	58 22	63 32	−5 10
Ramona	J	10	273	5,507	4.01	221.18	258.04	55 29	56 62	−1 33
Springwood	H	2	315	7,279	3.03	220.93	257.75	55 23	67 27	−12 04
Mercena Net	H	7	290	6,856	3.22	220.71	257.49	55 18	66 28	−11 10
Beauty 3rd	H	1	301	7,854	2.76	216.60	252.70	54 15	45 67	8 48
Glennie O.A.C.	A	2	304	4,994	4.3	214.26	249.97	53 56	47 00	6 56
May Queen O.A.C.	A	2	292	5,312	3.87	205.41	239.64	51 35	62 66	−11 31
Rose 3rd	A	6	300	6,302	3.13	197.37	230.26	49 34	38 45	10 89
Toitilla Rue	H	1	263	5,937	3.31	196.67	229.45	49 17	38 79	10 38

In connection with the report of the dairy herd, it will be noted that the cost of maintenance runs very high. This is due to several reasons. A large part of our dairy herd is kept stabled summer and winter, which adds very materially to the cost, especially last year, when we were short of silage and had to feed considerably more hay in consequence. In addition to this, the cost of feed generally last year was very high, and if anything approaching market prices for food stuffs are used in estimating cost of maintenance, it will be found that the cost of keeping live stock has increased very materially during late years. At prevailing prices for feed, it takes a good cow to leave any considerable margin between the value of her product and the cost of maintenance, provided the foods are charged at market prices.

It will be noted that most of the losses shown in the report were incurred in the case of cows, which had not completed a full period of lactation during the year, but which have been charged with a full year's maintenance. Take one year with another, the chances are these cows would show a slight profit. Some of the heaviest losses were incurred by two-year old heifers which had not completed their full period of lactation.

Sheep.

Our flock of sheep is small, consisting of nineteen breeding ewes and ten yearlings in the winter of 1912, and representing Leicesters, Oxfords, and Shropshires.

The ewes lambed somewhat late, the earliest lamb coming on April 3rd, and the latest on April 26th.

On November 20th, we had on hand 32 lambs as the produce of the 19 ewes, and the average weight of the lambs on the date mentioned was 120 lbs. The lamb crop, therefore, may be regarded as satisfactory, both in numbers and quality, bearing in mind that they were late lambs.

The weight of unwashed wool was as follows:—

5 Oxford ewes,	Average fleece,	9½	lbs.
3 Oxford shearlings,	" "	12½	"
7 Shropshire ewes,	" "	9½	"
4 Shropshire shearlings,	" "	8½	"
7 Leicester ewes,	" "	9	"
3 Leicester shearlings,	" "	11	"
1 Aged Leicester ram,	" "	16½	"

Treatment for Tapeworm in Sheep.

For many years, tapeworm has been troublesome among the College sheep, but of late years we have been able to stop its ravages by treating all lambs before symptoms of the disease appear. If treatment is delayed until the lambs become unthrifty, many of the lambs never make a satisfactory recovery and become stunted in their growth. We have tried different remedies, the principal ones being as follows:—

Gasoline: Mix gasoline and milk in proportion of 1 to 7. Dose, 3 ounces of mixture for every 100 pounds weight of sheep.

Turpentine: Dose, 1 teaspoonful in milk.

Areca Nut: Dose, 1 teaspoonful in milk.

Oil of Male Shield Fern: Dose, 1 teaspoonful in 2 ounces of castor oil.

Copper Sulphate (Blue Vitriol): Dissolve one pound (avoirdupois) of copper sulphate, blue crystals, in 2 quarts of boiling water, which will constitute stock solution. Add to stock solution 7 4-5 gallons of water to dilute ready for use. To dilute in small quantities, add a little short of a pint of water (39-40 of a pint) to each fluid ounce of the stock solution.

Dose of diluted solution:—

Lambs	1	month old,	⅔	of a	fluid ounce.
"	2	months "	1⅓	fluid	ounces.
"	3	" "	2	"	"
"	4	" "	2⅔	"	"
"	5	" and over,	3	"	"

Fast lambs 15 to 18 hours before giving medicine, and give no water or feed for 6 hours after dose is administered.

The directions regarding fasting apply to all the remedies. It is little use to give medicine for worms without first fasting the animals.

We have had very fair results from nearly all the remedies mentioned, but the oil of male shield fern with castor oil has proved very effective, and appears to be entirely harmless to the animals. The main objection to the remedy is the cost, which runs in the neighborhood of five cents per animal for each treatment.

Copper sulphate has also proved very effective, and is very cheap, the cost being a mere trifle for a large flock. It is a poisonous substance, and it will not do to repeat the dose in a few days as is sometimes done with other preparations. At least a week should be allowed to elapse between treatments, if a second treatment is given.

We usually give two treatments about a month apart. For example, in 1912 our lambs were treated on July 31st and August 21st. A considerable amount of tapeworm was expelled after treatment, and our lambs were never more thrifty than they have been this year.

When drenching a lamb, be sure that it is standing in a natural position on its feet (not in a crouching position). Hold the animal's head so that the nose is no higher than the eyes, and pour the liquid very slowly.

The Bang System of Handling Tuberculous Cattle.

For a great many years, occasional cases of tuberculosis have appeared among the College cattle, but it was not until the spring of 1909 that we undertook to stamp out this disease and at the same time not to sacrifice our most valuable breeding animals. I might say that the milk from the tuberculous cows is all pasteurized before being used, and any cow that shows serious signs of breaking down with the disease is slaughtered, the carcass examined carefully, and then destroyed. I might say, however, that the majority of the cows in our tuberculous herd are as healthy looking cows as a person will see in any herd, and no person would know that these animals represent our diseased herd if he were not told. The following description of our work along this line, up to date, has been prepared by my associate, Prof. R. W. Wade, who has been indefatigable in his efforts to bring this undertaking to a successful issue.

In the spring of 1909, the beef and dairy herds were tested for tuberculosis. The beef herd, consisting of thirty-seven animals, gave the following results:—fourteen gave no reaction, eighteen reacted, and five gave doubtful readings. Of the five doubtful ones, three afterwards reacted. The other two gave no reaction in subsequent tests and so are counted with the clean herd. As a final result, we had in the beef stable, sixteen free from the disease and twenty-one reactors. In the beef stable, the reactors were either killed or removed to a quarantine stable, so we started the beef herd with sixteen sound animals. After the first year, no calves from diseased animals were put in this stable, so we have not practised the Bang system with the beef herd, but all animals are tested twice a year. Before dismissing the beef herd, I might mention that this herd had rather more sanitary surroundings than the dairy herd, were kept in a brighter stable, better ventilated, and all animals except young calves were allowed to be out doors during the middle of the day.

The dairy herd consisted of thirty animals. Of these, twenty-one reacted, two were doubtful, and seven passed clear. The two doubtfuls reacted to the next test, and of the seven non-reactors three afterwards reacted, so as a final result we had in the dairy stable twenty-six reactors and four non-reactors. Of these twenty-six reactors, fourteen have been slaughtered during the last three years,

leaving twelve now in the quarantine stable. Of the fourteen slaughtered, with one or two notable exceptions, nearly all were found on post-mortem examination to be very badly diseased. Of the four non-reactors, two have been killed and found to be free from disease. The remaining two are still in the clean dairy stable.

As the reacting animals were very valuable from the breeding standpoint, they were kept in the quarantine stable for the sake of their offspring, which we hoped to add to our clean herd. The calves from reacting cows were, shortly after birth, put in the clean stable and fed milk from healthy cows. At the present time, there are twenty-five heifers and young cows which have passed the tuberculin test this present fall, and of these twenty-five, three were from healthy cows, and twenty-two had tubercular mothers. To sum up, in three years we have a beef herd of fifty-four animals free from disease, a clean dairy herd of thirty animals, and a small tubercular herd. How has this been accomplished? First, by the most careful use of the tuberculin test. Second, by removing all reactors from the sound herd. Third, by the most careful method of sanitation, the use of hot lime and carbolic (every stable on the College property being sprayed with hot white-wash at least once a year). Fourth, the close quarantining of all reacting animals. Fifth, having separate attendants to look after each herd.

As an instance of the value of some of these methods, I will cite a few cases that came under our observation. A calf born in the tubercular stable, April 13th, 1911, was kept there and given milk from one of the cows in that stable whose udder was perfectly sound. This calf was killed September 26th, and found to be tubercular. Another calf kept in the tubercular stable through the winter of 1910 was allowed to suck one of the cows, the only precaution being taken that the cow's udder was washed off before allowing the calf to nurse. This calf was slaughtered in the spring of 1910, and we could find no trace of the disease. Two cows had calves, one in October and the other in November, the former in the tubercular stable and the latter in the clean stable. The tubercular cow's calf was immediately taken to the clean stable and fed milk from healthy cows. The healthy cow's calf was put on this tubercular cow and isolated in a roomy shed where calf and cow ran together. These calves have been tested, the one in the clean stable at least three times, and it has always passed the test. The calf with the tubercular foster-mother reacted to the first test.

As far as our experience goes, it would seem to show that the only sure and certain way to keep a herd free from the disease is by the use of the tuberculin test, and the strictest kind of quarantine. I am aware that there are men who honestly believe that they can recognize a diseased animal without the aid of the test. We have not found it so at the College, and some of the greatest surprises have confronted us in the reaction of animals which from their general appearance and thrift, one would almost be sure were healthy. We have had young steers making satisfactory gains, which, when tested, gave clear reactions, and when slaughtered were found in some cases badly diseased. As an instance of what production of milk might be got from an animal in the last stages of the disease, I will give the milk yield of one of our dairy cows:—

October,	31	days,	709	lbs.	milk.
November,	30	"	978	"	"
December,	31	"	975	"	"
January,	31	"	907	"	"
February,	28	"	684	"	"
March,	29	"	742	"	"

This gives an average for the last one hundred and eighty days of nearly thirty pounds per day. This cow was slaughtered the last of March, and was found to be diseased in practically every important organ of the body. One could hardly believe that an animal so far gone with the disease could actually give, for the last four weeks of her life, nearly twenty-six pounds of milk per day.

Contagious Abortion of Cattle.

During the past year, many inquiries regarding contagious abortion in cattle have been received at this office, and the increasing frequency of these inquiries leads one to believe that this very serious disease is on the increase in the province. We think it important, therefore, that the best information we can obtain should be placed before the public, and the suggestions which follow are based upon the findings of the best investigators, and also upon our own experience.

In 1905 a committee was appointed by the Board of Agriculture and Fisheries of Great Britain to investigate the problem of dealing with contagious abortion, and this committee, after several years of painstaking work, including numerous experiments, has issued a preliminary report which contains many important statements regarding the disease. Some of the principal points are summarized below:—

1. Contagious abortion in cattle is caused by a specific germ which has been isolated by several investigators, including the committee in question.

2. The contents of the infected uterus, that is to say, the exudate, the foetal membranes, and the foetus, are all virulent, or, in other words, they contain the germ that will transmit the disease to other animals. As long as the affected uterus remains closed, these materials are not dangerous so far as other animals are concerned, but once they have been expelled they become dangerous. The discharge which comes from the genital organs for a varying time after the act is also virulent. It is improbable that abortion germs are excreted in the milk of affected cows.

3. Once the contents of the uterus have been expelled, the virulent material may be carried to other parts of the stable along the drains. Virulent material may also be carried in manure, on the coats of animals, and on the hands and boots of attendants. The water supply may also become affected, and dogs, or other animals, may carry portion of an aborted foetus to different parts of the farm or to adjoining farms.

4. Affected in-calf cows may be introduced into a clean herd, and be a means of starting the disease in that herd.

5. Cows which have aborted must be considered dangerous so long as the discharge continues to come from the genital organs, which is often several weeks, and sometimes an intermittent discharge continues for two months, or even longer. Such animals, if not isolated, will infect stables or pastures, as the case may be.

6. There are two natural methods in which virulent material may gain access to the pregnant uterus, viz., by the vagina and by the mouth.

7. Experiments conducted by the committee go to show that infection by way of the mouth is probably the most common method. The germ is taken in with the food and from the stomach gains access to the circulation, eventually reaching the foetus. This claim is strengthened by the fact that the injection of virulent material directly into the circulation invariably produces abortion.

8. The report does not attach so much importance to the bull as a source of infection as is done by some other authorities, though it is admitted that the use of a bull upon an infected cow, and the subsequent use within a short time upon a healthy cow might be the means of transmitting the disease.

9. It is not regarded as probable that the germs can live very long in the uterus of a non-pregnant cow, and cases are cited where no germs of abortion could be found a month after abortion had occurred.

10. In some cases, cows abort without showing any premonitory symptoms. In other cases symptoms may be apparent for periods varying from a few hours to two or three days. One of the first symptoms is swelling of the udder. When this occurs earlier than is natural it is a suspicious sign. The vulva is slightly swollen, and the ligaments slightly relaxed. There is commonly a discharge of mucus from the vulva, which may be blood-tinged or yellow. Where cows abort during the early stages of pregnancy, the foetus may come away completely enveloped in the membrane, but in the later stages of pregnancy the membranes may be retained in whole or in part, and are difficult to remove by hand. After abortion, a thin yellowish discharge continues to come from the genital organs for several weeks, and may continue for a much longer period in cases where the placenta has been retained.

11. In some cases cows become comparatively immune (not subject to the disease) after one attack, but other cows may abort several times. The members of the committee are inclined to believe, as a result of their investigations, that a majority of cows at least acquire a serviceable degree of immunity as the result of an attack, but there is no doubt that a considerable number abort twice, and a small number abort even three times.

12. Methods of artificially rendering cattle immune are under investigation.

13. The feeding of carbolic acid as a preventive and cure for the disease was tested by the committee and is pronounced useless.

14. Following is a summary of suggestions made by the committee relative to the suppression of the disease:

(a) Spraying the external genital organs at intervals with disinfectants is regarded as comparatively useless so long as the cows remain in an infected stable, but immediately before removing an animal from infected to clean premises, it is advisable to thoroughly wash the posterior portions of its body with a disinfectant solution, such as one part of corrosive sublimate to 2,000 parts of water, or a 3 per cent. solution of carbolic acid.

(b) Isolation of affected animals immediately before, and for sometime after abortion occurs, is stated to be of great importance. This means a close watch for symptoms, so that animals may be removed to other quarters as soon as they show any signs of abortion. When a cow aborts before being removed from among the others, subsequent isolation is not so effective as though she had been removed before abortion occurred.

(c) It is believed that the genital organs cleanse themselves by natural means within a comparatively short time after abortion occurs, but so long as a discharge continues to come from the genital passages, it is recommended to cleanse once or twice a day by the intra-vaginal injections of tepid antiseptic solutions, such as a two per cent. solution of carbolic acid, or one part of corrosive sublimate to three thousand parts of water. It is seldom necessary to continue the injections for more than a month, and after three months the cow may usually be bred again with safety.

(d) The practice of selling to the butcher all cows which abort is regarded as a mistake. Such cows, if properly handled and not bred again until perfectly clean, are less likely to be affected by the disease than new ones brought into the herd; so that a man is safer with his own cows which have been exposed to the disease than with purchased cows which have never before been exposed. There are cases, however, where cows which have aborted cannot again be got in calf, and of course such must be disposed of.

(e) Where a separate bull is not kept for cows which have aborted, it is advisable to disinfect the external genital organs of the bull after service.

(f) After abortion occurs, it is extremely important that the soiled litter, dung, exudate, membranes, and foetus should all be removed at once, preferably after they have been treated with caustic lime. It is recommend to soak in paraffin and burn, or to bury deeply. On no account should the membranes or foetus be fed to pigs or dogs, nor should any of this contaminated material find its way to the manure pile. When a foetus is aborted alive, it is advisable to kill and destroy it along with other infected material, unless it appears strong enough to survive, in which case it should be isolated for some weeks. The walls and floor of the stall where the abortion has occurred should be washed or strewn thickly with caustic lime, or drenched freely with boiling water. It is also recommended to disinfect the boots, clothing, and hands of the attendant with a reliable disinfectant, such as a 3 or 4 per cent. solution of carbolic acid.

Further Suggestions.

The report summarized above is not of the most encouraging nature to those whose herds are troubled with this disease. The average man would naturally wish for something simpler and involving less labor than the methods proposed by the committee, but all contagious diseases must be fought in much the same manner, and no exception can be made of contagious abortion. We would like to add a few additional suggestions which may prove helpful.

The owner of an infected herd should keep a table showing the exact date of service of every cow, so that he knows when each cow is due to calve. In addition, he should cultivate the habit of watching every animal for symptoms. Should an animal show any signs of approaching parturition at a date which his record shows to be too early, he should lose no time in removing it from among his other cows. If animals can be isolated before they abort, the chances for overcoming the disease are greatly improved.

In case a cow should abort in the stable, the foetus and all other infected material should be destroyed at once, or buried deeply, and the stall, gutter, etc., thoroughly disinfected, the cow being removed to another stable until she is clean. The report mentions hot lime whitewash or boiling water for cleansing the stall, but any good disinfectant will answer.

Perhaps the most troublesome cases are those which occur while the cows are on pasture, and every effort should be put forth to prevent this occurrence. This means keeping a strict lookout for symptoms of abortion throughout the summer, so that suspicious cows may be isolated before aborting. Since it appears to have been demonstrated that infection can take place through the mouth, it is easy to see how an aborting cow can contaminate a large amount of pasture. Any cow which has aborted should never be allowed to pasture with in-calf cows if there is any discharge from the genital organs. Females which have not been bred will take no harm from exposure to the disease.

The report recommends a 2 per cent. solution of carbolic acid, or a 1 in 3,000 solution of corrosive sublimate for irrigating the vagina daily after abortion until the discharge has ceased. The trouble with these substances is that they are apt to cause severe straining. A solution of boracic acid does not cause straining, and appears to hasten recovery, but it is much more expensive than the other solutions mentioned. Use a tablespoonful of boracic to a quart of water.

Immediately after abortion, and as soon as the placenta has been removed, it is a good plan to flush out the uterus with the boracic solution, but as soon as the mouth of the uterus closes the injections should be made merely into the vagina. About a quart of the solution will answer for flushing out the vagina, but when the uterus is flushed out about a gallon of the solution will be required.

A simple and convenient device for giving these injections can be arranged as follows: Take a wooden pail, or, what is better, a "papier mache" pail. Bore a hole in the side close to the bottom. Fit into the hole a perforated cork through which is inserted a short piece of glass-tubing of about one-quarter inch bore. Slip a piece of rubber tubing over the end of the glass tubing, and to the other end of the rubber tubing attach an ordinary hardened rubber syringe tip. To stop the flow, use a wire spring clip on the rubber tube. Clips can be bought for this purpose. The rubber tubing should be at least three feet long. The solution is put into the pail and an assistant holds the pail higher than the cow's back, or wire hooks for holding the pail can be suspended from the ceiling behind the cows to be treated. With such a device a number of cows can be treated in a very short time. If the corrosive sublimate solution is used, it should not be allowed to come in contact with any kind of metal. The device described is suitable for any solution.

Annual spraying of the stables with hot lime whitewash is good practise in any herd.

In the report of the committee, it is stated that it is usually safe to breed cows again about three months after they have aborted. A pretty safe rule is not to breed until six or eight weeks after the time the cow was properly due to calve as shown by the record of service, assuming, of course, that all discharge has ceased and the cow is apparently normal. Cows which abort at a very early stage of pregnancy may be bred somewhat sooner, but it is well to allow sometime to elapse after all discharge has ceased before breeding again.

The whole question of handling contagious abortion is largely a matter of isolation, disinfection, destruction of virulent matter, unceasing vigilance in the matter of watching for symptoms, and avoiding as far as possible the purchase of new cows. The man who attempts to get rid of contagious abortion by selling aborting cows and buying new ones is liable to much greater loss than the man who retains every cow which can again be got in calf, because the newly-purchased cows are much more likely to abort than those which have had an attack of the disease.

This subject has been dealt with at some length because of the many questions we have received regarding it, and the impossibility of answering each man fully by letter.

Respectfully submitted,

G. E. DAY.

PART X.

THE PROFESSOR OF POMOLOGY.

To the President of the Ontario Agricultural College:

SIR,—I beg to submit herewith report of the Department of Pomology for the year 1911-12.

The lecture work of this department has proceeded as usual. I beg to call your attention again to the statements made in the Annual Report for 1910-11 regarding size of classes and accommodations for same. I trust, too, that the services of an assistant in Pomology may soon be placed at the disposal of this department, as the need for such is very great.

The fourth annual Short Course in Fruit Growing was held from January 23rd, to February 2nd, 1912, and was decidedly successful. We desire to thank those from outside points ho assisted us in the lecture and instruction work in connection with this course, including Messrs, F. M. Clement, P. E. Angle, S. E. Todd, P. C. Dempsey, R. Thompson, and James E. Johnson.

In connection with the short course, we also ran courses in Box and Barrel Packing of Apples. As Instructor in Box Packing, we were fortunate in procuring through the kindness of Mr. J. A. Ruddick, Dairy and Cold Storage Commissioner, Ottawa, the services of Mr. James Gibb, of Kelowna, B.C. Mr. Ruddick also very kindly allowed Mr. P. J. Carey, Chief Inspector for Western Ontario, to be with us as Instructor in Barrel Packing throughout most of the course. Mr. W. F. Kydd, of the Department of Agriculture, Toronto, efficiently substituted for Mr. Carey during the latter part of the course.

It was my very great pleasure during the past summer to spend several days with Dr. J. P. Stewart, of State College, Pa., studying the results of extensive co-operative tests of fertilizers and cultural methods of apples, which have been carried on for some years by him.

The fruit crop in the departmental plantations has been above the average this season in all fruits, although a certain amount of apple scab developed during the latter part of the wet, cool summer.

We are glad to report that additional land for fruit-growing purposes has been placed at the disposal of this department. Planting will be proceeded with in the spring of 1913.

Mr. A. H. MacLennan, who is in charge of Vegetable Gardening, submits the following report with regard to experimental work concluded this season:—

A steam outfit for sterilizing greenhouse soil was installed last spring. The results of partial sterilization of soil for tomatoes have been very marked indeed, as the accompanying figures will indicate:

140 plants sterilized produced 936.6 lbs. fruit = 6.69 lbs. per plant.

40 plants unsterilized produced 176.9 lbs. fruit = 4.42 lbs. per plant.

Bacterial examination showed the presence of 1,600,000 bacteria per cubic centimetre of soil in the unsterilized section. In the sterilized soil there were 900 bacteria per cubic centimetre at a depth of two inches and 600 per cubic centimetre at a depth of 6 inches. In the unsterilized soil many of the bacteria were of

injurious forms, while in the sterilized soil those which remained are all beneficial. The determinations of bacteria were made immediately after sterilization. Temperature readings at the same time showed 214°Fah. at a depth of two inches and 178°Fah. at a repth of six inches, one minute after the removal of the steam pans. Eelworm, which formerly has been very destructive, has been entirely eradicated by sterilization.

New Varieties.

Greenhouse Tomatoes.

For description of Clipper and Industry, see 1910 report, page 148.

Bonny Best. A dark red tomato which is being grown extensively both outside and under glass. Large, smooth, and well colored. Carries its clusters well together.

Hipper No. 2. A new English variety, shaped very much like Bonny Best. Dark red in color with thick flesh. A heavy cropper, fruits running three to five to the pound.

Cabbage.

Copenhagen Market. New early cabbage, coming as quickly as Early Jersey Wakefield. Heads round, medium size, and very solid.

Sutton's Earliest. As early as Early Wakefield, but larger in size. Is the same pointed shape.

Enkhuizen Glory. Good for second early or late crop, round solid heads weighing from eight to ten pounds each.

Onions.

Denia. Very large, yellow globe, of the Giant Gibraltar type. Is excellent for transplanting. Single specimens weigh from one to two and three-quarter pounds.

White Leviathan. Large flat white onion. When transplanted makes a fine bunch onion. Full grown specimens weigh from one and a half to two and a half pounds.

Respectfully submittted.

J. W. CROW.

PART XI.

THE PROFESSOR OF LANDSCAPE GARDENING.

To the President of the Ontario Agricultural College:

SIR,—I have the honor to present herewith a brief report from the department of Landscape Gardening for the past year.

The aim of this department is to cultivate a taste for good landscape art; to foster the general movement for rural and civic improvement, and to assist in every way possible those who are working for a better and more beautiful Canada.

The object is one well worthy of the best effort of every Canadian citizen, and we are glad to know that many influential organizations are now working unitedly with this end in view. Our efforts have been through the lectures given to our students, as provided for in the curriculum; through outside lectures to various organizations throughout the Province; and by assisting with advice and plans school boards and other public organizations in the improvement of school and other public grounds.

OUTSIDE LECTURES.

Lectures, most of them illustrated by means of the stereopticon, were given during the year as follows: To Horticultural Societies at Toronto, Grimsby, Thorold, Merritton, St. Catharines, Port Dalhousie, Paris, Markdale, and Hanover. To Boards of Trade at Haileybury and Brockville. To Women's Institutes at Aylmer and Waterdown. To Local Improvement Societies at Birr and High Park; to the Ontario Horticultural Association, the Ontario Vegetable Growers' Association, and the Broadview Institute, Toronto; to the Canadian Club at Pembroke; to Public Schools at Stratford, Sebringville, and New Toronto; and to the Provincial Normal Schools at Hamilton, London, North Bay, Peterboro and Ottawa.

IMPROVEMENT OF SCHOOL GROUNDS.

Believing that the public schools are, after all, the most effective educational centres in the land, we have been endeavoring to bring about an improvement in the homes of the people by beginning with improvements on the school grounds. School boards have not, as a rule, realized the value of environment in the education of the child, or they would not have so long neglected the opportunity which is theirs of making the school and its surroundings a model of good taste in building and planting. In addressing teachers at the various Normal Schools, we have appealed to them as missionaries going out into new fields to try to bring the light of this gospel to their school boards. And as soon as they can get school boards to act in the matter, we are ready to assist them with plans, planting lists, and advice suited to their particular needs. Such assistance has been given at many schools during the past few years, and at the following during the past year: Agincourt, Birr, Bobcaygeon, Cape Croker, Chesterville, Chapleau, Collingwood, Dymond Township, Dunnville, Guelph, Goderich, Grimsby, Haileybury, Louth Township, Kingston, Leamington, Listowel, Moorewood, New Liskeard, New Toronto, North Bay, Palgrave, Stratford, St. Catharines, Sault Ste. Marie, Sudbury, Shetland, Silverdale, Sebringville, Thornbury, Vallentyne, Waterdown, and Winchester.

Lessons Learned Abroad.

It was my pleasure last summer to spend a short holiday in the Old Land, with the object of getting new inspiration, and learning as much as possible from what might be looked upon as the fountainhead of gardening and landscape art. It was my privilege to visit a number of the large private estates, where some of the finest gardens and grounds in the world are to be found, and I came home convinced that, notwithstanding our rapid progress in this new land, we have yet much to learn from the Mother Country, particularly in road-making, home-making, general landscape gardening, and floriculture. By good use of the camera, I brought home with me many pictures which will be valuable in my work here and in illustrated talks throughout the country, helping on the cause of rural and civic improvement.

Floriculture.

Mr. Wm. Hunt, Lecturer in Floriculture, submits the following on his work in floriculture:

The regular course of instruction in floriculture has been given to all of the College classes as provided for in the curriculum, and also to the teachers' classes during the spring and summer. This work is made as practical as possible and each student propagates and cares for a collection of house and garden plants which may be taken home at the end of the term as a nucleus for a home collection.

Addresses were given to Horticultural Societies at Grimsby, Toronto, London, and Strathroy, and to the Women's Institute at Forest.

I also acted as judge at several horticultural exhibitions during the summer and autumn, as well as acting in the same capacity in the lawn and garden competitions arranged for by the High Park Ratepayers' Association, Toronto, and the Horticultural Society, Milton.

At the request of the Department of Natural Resources of the Canadian Pacific Railway, I spent my holiday in August making an advisory tour of inspection of the station grounds and nurseries of the Western Division of the C.P.R. from Fort William to Vancouver. This proved a most interesting trip to me, and was, I trust, equally profitable to them.

Numerous articles on floral topics have been contributed to the press during the year.

Recent Floral Introductions.

Among the many new varieties of plants tested in our greenhouses and flower borders, the following are worthy of particular note at this time:

Rainbow Corn. Annual. A beautifully marked, richly colored species of maize, one of Luther Burbank's introductions. Will prove a very ornamental and easily grown decorative plant, if the type can be kept true by careful seed selection.

Physostegia Virginiana (False Dragon Head). Hardy perennial, 3 to 4 feet in height, very acceptable in the border during the hot months of July and August.

Dictamnus or *Gas Plant.* Perennial. Three feet in height. Another hardy border plant that is too seldom seen in collections of perennials. A very suitable plant also for planting in cemetery plots.

Marguerite, Mrs. F. Sander. New 1911. An excellent decorative plant for the garden in summer or for the greenhouse in winter, an improved type of the well known *Chrysanthemum frutescens* or Paris Marguerite.

Pentstemon Gloxinoides. This improved type of these showy plants is a great improvement on the older varieties grown a few years ago.

Primula malcoides. The dense, green, fimbriated foliage of this new variety of Primula surmounted by its tall, dainty, delicate spikes of lavender pink flowers make this a pleasing addition to greenhouse primulas.

New Chrysanthemums.

Among the new varieties introduced this year the following are worthy of note:

Aesthetic. Color, a soft, pleasing, silvery primrose yellow. An exquisite variety.

White Gloria. A white flowering sport from the well known early flowering pink Gloria introduced a few years ago.

Nantero. A tall, strong growing, strong stemmed variety, having flowers of immense size of a very pale pinkish white.

Christy Mathewson. A very large, pure white Japanese flower, borne on a strong wiry stem. An acquisition.

Artistic Queen. The blooms of this variety are of a rich rose pink color, loosely incurved. A useful variety for the professional or amateur.

Dick Witterstaetter. An introduction of 1910. A large loose Japanese recurve bloom. Color, a rich lake crimson. A good pot plant.

Helen Newberry. A pure white pompon. Should prove useful in a home or commercial collection.

New Geranium, "Alliance." This is a hybrid between the ivy leaf and the zonale type of geranium. A very pretty and easily grown variety for an amateur's collection. Semi-double, flowers pale pink with carmine blotch on centre petals.

Respectfully submitted,

H. L. HUTT.

PART XII.

THE PROFESSOR OF POULTRY HUSBANDRY.

SIR,—I have the honor to present herewith the report of the Poultry Department for 1912.

The usual courses of lectures have been given to regular students, also to the Short Course. A number of educational exhibits have been made at fairs, and there has been, as usual, several lectures to Farmers' Institutes, Farmers' Clubs, Poultry Shows, etc. In previous reports the increasing demand for such lectures and also the need of further assistance for the work has been mentioned.

During recent years more attention has been given to the poultry on the farm. There is at present a serious loss in marketing poultry products, which is particularly true in regard to eggs. Our aim shall be to get the eggs from the producer to the consumer more quickly, and in better condition, than is now being done. We also hope to be able to assist the dealers in taking care of their poultry products.

There is need of educational work on the care of eggs, not only with the producers, but with the dealers and the consumers. Many dealers and consumers forget that eggs will absorb flavors almost as readily as does milk. Others appear to think that eggs will start hatching only when put in an incubator or under a hen. The dealer who exposes eggs for sale in store windows, with the sun rays directly upon them, has a mammoth incubator in operation, or the consumer who places eggs in a cupboard near a cook stove may also be hatching eggs.

I was permitted to attend the first meeting of the International Instructors and Investigators' Association, held in London, England. Over twenty different countries were represented at this meeting. It is not necessary for me to mention that such a meeting not only gives to those who attend much information in regard to the experimental work, but more particularly the magnitude of the business and the best methods of giving information.

While abroad I had the pleasure of studying, rather closely, the educational breeding and marketing methods of Ireland, Scotland, England, and Denmark. A report on this work will be published in bulletin form.

NEW EQUIPMENTS.

With a more liberal grant we have been able this year to construct a new breeding house, over two hundred feet in length, containing thirty-two pens. The house will be used entirely for breeding investigations. In past years we have been doing some work along the lines of improvement in egg production with certain breeds. The most recent scientific work indicates that egg production is largely hereditary through the male, and moreover our own pedigrees, while limited in number, appear to substantiate the theory. It would, therefore, seem necessary to test the laying power of the offspring of a larger number of males and it is with this particular object in view that we have erected the house.

We have also been able to install a large, coal heated, hot water incubator. This machine has a capacity for three thousand eggs. A large machine with uniform hatching conditions is necessary for doing pedigree work. This machine will also be useful for class work as well as being adaptable for incubator experiments.

We are in need of a brooder house, of a long pipe system. The present brooder house is adaptable to the use of individual brooders but is too small for our present needs. It would, therefore, be wise to construct another brooder house, which would be valuable for class work and at the same time lend itself to experimental work in general.

The Stock.

This has been an unusual year. The severe winter weather not only reduced the general average winter egg production but appeared to also affect the hatching power of the eggs. Usually there is some difficulty throughout the season in getting strongly fertilized eggs from a few matings, but this year we obtained good and poor hatches in alternate weeks in the early season and it was not till late spring that w could depend on the eggs for hatching. Chicks have grown well, much better than was generally expected considering the wet season.

Eggs.

Neither the summer nor the winter egg production was equal to that of last year. The demand for eggs for hatching was about equal to that of 1911 but the general report of the egg shipped was not so good, and moreover we never had such poor results in shipping eggs. No matter how carefully packed, the express companies usually managed to break some eggs.

The pullets hatched this year are now laying as well as in any other year, possibly better.

Breeding for Eggs.

We have been trying to improve the general average egg production for a number of years and our work has been fairly successful. Nearly all who have purchased our bred-to-lay lines have been well satisfied, but a few have not received the results they expected. Some appear to think they can obtain good egg production from improper feeding, unsystematic attention, late hatching, and poor housing.

The egg production of 1911 was exceptional and that of 1912 has fallen back somewhat, but it is a slight advance over 1910, so that in general, considering the unusual year we have done fully as well as was expected. It must be remembered that it is a comparatively easy matter to raise the general average egg production from 110 eggs per hen per year to that of 130 or 140, but further advancement is more difficult, especially with increasing numbers of birds.

Animal Foods as they Affect Egg Production and the Hatching Qualities of the Egg.

An experiment was started three years ago, with the object of studying the effect which various kinds and quantities of animal food might have upon the production and the hatching power of eggs. The plan of the experiment was to use a different breed each year, and to continue the experiment for at least five years. It was thought that the results would vary somewhat with the different breeds, and possibly with different families of the same breed.

Below is given the results of the first three years work, that of 1909-1910 being carried on with Buff Orpington pullets, that of 1910-1911 with Rhode Island Red hens and pullets, and 1911-1912 with Leghorn pullets.

There were twenty-five females and two males in each pen, and all were housed in the same building. The grain and green food used were the same for each pen.

The animal food are reckoned at the following prices:

Buttermilk 20c. per 100 lbs. Beef scrap $3 per 100 lbs. Green cut bone $3 per 100 lbs.

Experimental Feeding with Buff Orpingtons.

The following are the results for 7 months, from Oct. 1st, 1909 to April 30th, 1910.

Pen No.	Animal food used	Lbs. whole grain	Lbs. dry mash	Lbs. animal food	Total cost	Total eggs laid	Cost dozen eggs	Percentage of eggs hatched
1.....	Buttermilk	720	233	1453	$18.16	2040	10.68	55.0
2.....	10% dry mash beef scrap.....	840	337	34	19.85	1670	14.28	50.5
3.....	Beef scrap in hopper.	900	216	141	22.21	1664	15.84	33.0
4.....	No animal food.....	900	224	....	17.99	1496	15.48	59.5
5.....	Green cut bone.....	900	196	127¾	21.37	1654	15.48	40.5

Experimental Feeding with R. I. Reds.

The following are the results for 8 months, Oct. 1st, 1910, to May 31st, 1911:

Pen No.	Animal food used	Lbs. whole grain	Lbs. dry mash	Lbs. animal food	Total cost	Total eggs laid	Cost dozen eggs	Percentage of eggs hatched
1.....	Buttermilk	973	535	1760.5	$25.60	1762	17.43	57.0
2.....	10% dry mash beef scrap.....	898	535	61.5	23.06	1320	20.96	56.4
3.....	Beef scrap in hopper.	907	510	106.0	23.92	1625	17.66	51.6
4.....	No animal food.....	802	405	....	17.70	730	29.09	66.25
5.....	Green cut bone.....	784	411	182.5	22.44	1359	19.81	64.5

Experimental Feeding with White Leghorns.

The following are the results for 7 months, Oct. 1st, to April 30th, 1912:

Pen No.	Animal food used,	Lbs. whole grain,	Lbs. dry mash.	Lbs. animal food.	Total cost.	Total eggs laid.	Cost per dozen eggs.	Percentages of eggs hatched.
1.....	Buttermilk	785	319	1,453	$19 46	1,508	15.5	68.2
2.....	Beef scrap in hopper.	750	205	81	16 76	1,158	17.3	69.2
3.....	No animal food.....	925	126	.....	15 77	602	31.4	74.2
4.....	Green cut bone	781	287	98	18 96	1,193	19.4	68.6

Comments on Above Tables.

With all three breeds buttermilk produced the most and the cheapest eggs.

Where beef scrap was fed in a hopper or where the birds could eat all they desired the Leghorns and Rhode Island Reds did much better than the Orpingtons.

No animal food in all instances gave the best eggs for hatching and the lowest egg yield.

From the results so far obtained it would appear to be a disastrous practice to undertake feeding Leghorns on no meat food ration, or meat food in very small quantities, for the reason that they developed feather eating to such an extent that some of the birds were killed and the males were a sorry sight, in fact, had to be frequently removed from the pen. This was true to a limited extent with the Rhode Island Reds but was not so of the Orpingtons.

Feeding.

The methods of feeding, and the kinds of feed given for laying hens, for rearing chicks, and for fattening chickens, has been given in detail in previous reports, also in Bulletin No. 189. There has been no change made in the past year, consequently a detailed report is not necessary.

Respectfully submitted,

W. R. GRAHAM.

PART XIII.

THE PROFESSOR OF BACTERIOLOGY.

To the President of the Ontario Agricultural College:

SIR,—I have the honor to submit the following report upon the work of the Department of Bacteriology during the year ending November 30th, 1912.

INSTRUCTION.

Lectures, demonstrations, and laboratory work in bacteriology were given to the regular course students of the College and Macdonald Institute, to the short course students in Dairying and Poultry Husbandry, to the Western Ontario Dairy Instructors, and to the Normal School and Summer School students, as outlined in the courses of instruction for these various groups.

Special lectures on Poultry Diseases, the Pure Milk problem, and on Tuberculosis were given.

Three of the members of the present senior class are following the work of the Bacteriology Option with the intention of making their profession in some phase of Agricultural Bacteriology.

EXTENSION.

The data on Avian Tuberculosis mentioned in my report of last year was published as Bulletin 193 early in the year.

Exhibits showing the relation of bacteria to dairying, soil problems, and plant and animal diseases, were prepared and shown on the Better Farming demonstration train in February, and at the Canadian National Exhibition.

Considerable material in the way of apparatus and supplies, specimens of plant and animal pathology, lantern slides, etc., have been supplied to the District Representatives of the Department of Agriculture.

As usual, there has been a large amount of material, such as water and milk samples for bacteriological examination, plant and animal specimens, spoiled foods, etc., sent in to the laboratory for examination, about one hundred and fifty samples in all. This number does not seem large, but in a laboratory not making a specialty of such work a great deal of time is involved. Some cases, moreover, require considerable work before definite results can be secured. As an example may be cited one sample of water sent to us from the supply of a cheese factory in the eastern part of Ontario. There was found in this sample an organism which was able to produce a disagreeable and fruity flavor in milk. An experimental cheese was made up by Mr. McKay of the Dairy Department, using a culture of this germ as a starter, and it was found that the organism could cause the same off-flavor in the cheese. The results were of interest and of value in adding to the knowledge we already have as to the possibility of the production of off-flavors in dairy products by obnoxious organisms in factory water supplies.

WORK IN SEED INOCULATION.

This work was carried on in much the same manner as last year. A total of 4,722 cultures, each sufficient for one bushel of seed, were sent out, of which 3,898

were for alfalfa, 570 were for red clover, and the remaining 254 were divided among alsike clover, white clover, peas, beans, vetches, and sweet peas. The greater number of the cultures were sent to farmers in Ontario, although a comparatively large number for alfalfa (132 and 162, respectively) were sent to Alberta and British Columbia. The total number of farmers to whom cultures were sent was 2,602, of whom 2,102 received cultures for alfalfa.

As heretofore, blank reports were sent out asking for results of the seed inoculation, and while the number of these reports thus far received is somewhat limited, the results as compiled from the 885 reports available show a decided benefit from the inoculation of the seed in 74.0 per cent. of cases.

This work is far beyond the experimental stage, and if it were feasible it would seem well to turn it over to the commercial interests, so that more time and thought could be devoted to other phases of the departmental work. I believe, however, that there is at present no commercial firm in Canada preparing similar cultures, and in view of this it may be advisable for this department to continue the work for another year.

In conjunction with this work with the legume bacteria, some preliminary investigation was done with the bacteria from the root nodules on Alder, *Alnus rubra,* in specimens sent to us from British Columbia. The organism from this plant is believed to belong to the same group as the bacteria from the root nodules on the legumes. At present, we have some experiments in progress as to the possibility of the alder bacteria infecting the roots of alfalfa and red clover.

Other Research.

As time from other duties permitted, we have engaged in research upon some soil problems, and factory dairy problems. We hope to be able to publish the results of this work during the coming year.

In conclusion, I would express my appreciation of the loyalty and efficient co-operation of the other members of the laboratory staff in helping to conduct the varied work of the department.

Respectfully submitted,

S. F. EDWARDS.

PART XIV.

THE PROFESSOR OF FIELD HUSBANDRY AND DIRECTOR OF FIELD EXPERIMENTS.

To the President of the Ontario Agricultural College:

SIR,—It gives me pleasure to submit to you the report of the work done in the Department of Field Husbandry for the year 1912. The work of the department during the past year has passed off satisfactorily along its various branches. The students have shown a deep interest in connection with both the inside and the outside work. The field experiments at the College have required very close attention, and in nearly all cases the crops have been satisfactory when the weather conditions are taken into consideration. The co-operative experiments in Field Husbandry throughout Ontario have been more extensive than at any previous time as upwards of five thousand Ontario farmers were actively engaged in this work in the past year. The correspondence has been very large, the letters averaging about one hundred and fifty per day for a part of the spring season, and some days reaching between two hundred and three hundred. It is probably safe to say that about 15,000 or 16,000 farmers visited the experimental grounds during the past season. These farmers were personally conducted through the Experimental Department, and the work was explained and some of the most important results were emphasized. The annual conventions of a number of the Provincial Agricultural Organizations have been addressed during the year, and the grain exhibits at some of our principal exhibitions such as, the Provincial Winter Fair at Guelph, the Canadian National Exhibition, Toronto, the Eastern Winter Fair at Ottawa, etc., have been judged either by myself or by members of the staff of this department. At the request of yourself, and of the Canadian National Exhibition a College exhibit representing ten departments was placed in the new Government Building on the Exhibition Grounds, Toronto. The Department of Field Husbandry not only installed its own exhibit, but also had the general arrangement and oversight of the entire College display.

EXPERIMENTAL GROUNDS AND EXPERIMENTAL WORK.

It is important for the reader to have a general knowledge of the experimental grounds, and of the methods adopted in conducting experimental work if he is to obtain the greatest amount of knowledge from the results presented in the following pages of this report. We, therefore, very briefly furnish information in this part of the report which is not only valuable in itself but which will avoid certain repetitions when giving the conditions under which the various experiments were conducted.

In 1912, as in each of several years past, the experimental grounds consisted of about fifty acres of land which have been divided into upwards of 2,000 plots, and on which experiments have been conducted with varieties of grain, root, tuber, grass, clover, fodder silage and other crops; with artificial, green and barn-yard manures; with methods of cultivation, selection of seed, dates of seeding, mixtures of grains, pasture grasses, etc.

The grounds have a gentle slope towards the south-west, and the soil is an average clay loam. About one-quarter of the land is manured each year with twenty tons of farmyard manure per acre; thus most of the land receives an application of farmyard manure once every four years. No commercial fertilizers are used except in distinct fertilizer experiments, and these occupy a comparatively small area each year. Within the past fourteen years, one green crop has been plowed under on each section of the field. The plots vary in size according to the requirements of the different experiments, and the yields per acre are determined from the actual yield of the plots in every instance. All of these experiments are conducted with the greatest care, and for several years in succession in order to secure strictly accurate results. These experiments deal with the crops grown on fully nine-tenths of the cultivated land of Ontario. A great deal of thought and care is required in planning, supervising and examining these plots, and in studying, comparing and summarizing the results for presentation in reports, bulletins, newspaper articles, and lectures.

Not only is it absolutely necessary to use the greatest possible care in the details of every experiment, but it is also very important to repeat the experiments for several years so as to secure fairly average conditions. All of our field experiments are conducted for at least five years before they are dropped, and many of them are continued for a much longer period of time. For the results of some of the tests which were carried on for five or more years previous to 1912 the reader is referred to former reports. The results of some of the experiments which have as yet been conducted for only one or two years are held over until the tests can be carried through for at least another summer. As different seasons vary so much in temperature, rainfall, etc., the average results of experiments continued for several years are of much greater value than those secured from only one or two season's work. Owing to the great care exercised in the work, and the number of years through which the experiments are continued, we are able to present the results with much confidence in their reliability and in their practical value. We believe that the reports of the experimental work are being more widely read and more carefully studied by the farmers of the Province, and that this is leading to a greater interest in crop production and to a deeper knowledge of plant life on the part of the farmers throughout Ontario.

Better Equipment for Work in Field Husbandry.

In the autumn of 1910 the writer secured options on five portions of land lying in close proximity to the College Farm and these options, with recommendations, were transferred to the Department of Agriculture. The Government of Ontario bought 150 acres which increased the size of the College Farm from 567 acres to 717 acres. Of the increased area the farm proper received 140 acres, and the Horticultural Department 10 acres. Through the kindness of the Superintendent of the farm proper and the consent of yourself and the Minister of Agriculture, the Department of Field Husbandry was allowed to take over about twenty-five acres of land lying directly to the south-east of the present Experimental grounds. As soon as the hay was removed in the early part of the summer this land was plowed, and later in the season the whole of the twenty-five acres was divided into ranges about forty rods long by four rods wide, with a road one rod wide extending between each two ranges. The sub-mains were extended along the road at the end of the ranges and one lateral was placed in the centre of each

range. The laterals were, therefore, five rods apart. We expect next year to use this section of land along with the former grounds for experimental purposes, thus making in all about 75 acres to be used for our experimental plots.

The Ontario Department of Agriculture granted for the erection of a building for the Department of Field Husbandry $40,000 out of the $175,000 received from the Federal Government. Plans for the building were completed in the summer, and the contract for the building was let in the latter part of the season. The building will be 163 feet in length and 46 feet in width, and will contain a basement, two floors, and an attic, each of which will be completed according to the plans and specifications. The building will contain class rooms, offices, work rooms, store rooms, a vault opening in each of three storeys, a freight elevator, etc. As there are three departments now occupying the present Agricultural Building, each of which has been crowded for room, the erection of the new building will furnish additional room to each of these departments, and we appreciate very much the prospects of better accommodation for the work of these departments.

Weather Conditions in 1912.

The Weather conditions at the Ontario Agricultural College have been somewhat unusual during the past year. The autumn of 1911 was about normal, the winter was very severe, the spring was somewhat cold and backward, and the summer has been unusually wet and comparatively cool. These general remarks will probably apply fairly well to the greater part of the Province. As it is important, for a proper understanding of results of experiments with farm crops, to know the weather conditions in the locality where the experiments have been conducted, the amount of rainfall in each of the summer months in each of the past thirteen years is here presented. The amount of rainfall has been carefully determined in each of these years by the Department of Physics at the College, from which department we have received the information. The following table gives the total amount of precipitation in each of the months of April, May, June, July, August and September in each of the years from 1900 to 1912, inclusive:

Inches of Precipitation During the Six Growing Months.

Month.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	Average thirteen years.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
April.....	1.69	2.24	2.43	2.69	2.10	1.82	1.44	1.66	1.33	3.60	3.13	1.67	1.14	**2.07**
May.....	1.03	3.26	1.67	2.44	3.01	3.89	2.71	2.64	3.47	3.43	2.75	1.64	5.64	**2.89**
June	4.47	1.53	3.06	3.05	2.86	3.24	4.06	1.11	3.21	1.33	.78	.89	1.51	**2.39**
July.....	3.05	4.07	6.43	2.67	4.99	4.60	4.65	1.92	3.25	4.54	1.89	1.95	2.53	**3.58**
August	.87	3.51	2.18	3.47	3.88	1.98	2.13	.62	2.75	.89	3.18	2.53	6.07	**2.62**
September .	1.52	2.45	3.58	1.48	2.80	2.85	2.49	2.87	.73	.86	3.29	3.42	3.08	**2.42**
Totals...	12.63	17.06	19.35	15.80	19.64	18.38	17.48	10.82	14.74	14.65	15.02	12.10	19.97	**15.97**

According to these results the total amount of rainfall at the College for the six months, from April to September, in the average of the past thirteen years was

practically 16 inches. In 1912 the amount of rainfall during the six months was almost 20 inches, which is 4 inches more than the average and nearly 8 inches more than the total rainfall for the same period in 1911. It will be seen that in 1912 the rainfall for May and for August was exceptionally heavy, and that for April, June and July was somewhat below the average. It will be understood that owing to the large amount of rainfall in the month of May it was very difficult to sow or plant some of our crops, and owing to the large amount of rainfall in August the harvesting of the crops was also very difficult. The heavy rainfall in these two months had a tendency to delay the ripening period of many of the crops; in fact, such crops as beans and corn were very much later than usual in ripening, and some of the later varieties were unable to reach maturity. The tabulated results show that the season of 1911 was an exceptionally dry one, hence the results of the experiments of these two seasons have a peculiar value of their own.

The Comparative Yields of Different Classes of Farm Crops.

In each of the past twelve years leading varieties of different classes of farm crops have been compared in duplicate experiments, with the object of securing the comparative yields of the different classes of farm crops rather than of the varieties themselves. This has been a distinct line of experimental work, and great care has been exercised each year to have the plots uniform in shape, size, and soil conditions. A large amount of work has been done at this Institution in former years in testing different varieties of the same class of farm crops, but practically nothing was done in making a careful examination of the yields of some of the different classes of farm crops previous to the starting of the experiment here referred to.

The following table gives the average yields of both straw and grain per acre of each of seven classes of farm crops for the twelve-year period:

Class of crop.	Average yield per acre for 12 years.	
	Straw (tons)	Grain (lbs.)
Barley	1.73	2,585
Emmer	1.99	2,562
Oats	2.34	2,499
Hulless Barley	1.68	2,345
Spring Wheat	2.16	1,882
Field Peas	1.49	1,806
Spring Rye	2.04	1,673

It may be a surprise to some farmers to observe the fact that barley has given a greater number of pounds of grain per acre than any of the other farm crops included in this experiment. The average yield for the twelve years of the barley over the oats has been 86 pounds per acre. In considering the fact that in the average of twenty-four separate tests made in the period of twelve years in which the barley gave an average yield per acre of 86 pounds per annum over that of the oats, it should also be remembered that the average percentage of hull in oats is about 30 and that of barley is about 15. Not only have these results been obtained in the experiments at the College, but a careful study of the reports of the Bureau of Industries for Ontario for the past thirty years shows very similar results. In

yield of threshed grain per acre, the barley has surpassed the oats by fully 120 pounds per acre, when we take into consideration the statistical reports of the Province for thirty years, as revealed by the publications of the Bureau of Industries. In the consideration of this subject the attention of the reader should also be called to the fact that barley surpasses oats in the percentage of digestible protein, and in the percentage of digestible carbohydrates, according to the latest and the best information which is obtainable. These various results tend to show the value of barley as a large producer of grain in Ontario.

Continuous Growth from Eighteen to Twenty-four Years of Each of Thirty-four Varieties of Farm Crops.

There is still a considerable amount of discussion in regard to the frequent change of seed of farm crops from one soil at another, or from one locality to another locality. Some farmers still think it is wise to change seed frequently. A large number of leading farmers, however, are realizing the fact that in very many cases they are able to grow the same varieties for a longer period of time without any change of seed, providing proper care is taken in growing varieties suitable for the soil, in the careful selection of the seed, and in the cultivation of the land. A number of varieties of oats, six-rowed barley, two-rowed barley, hulless barley, winter wheat, common spring wheat, durum spring wheat, and potatoes have been grown in our experimental grounds from eighteen to twenty-four years without a change of seed from outside sources, and the results are both interesting and instructive. In practically all cases the yields per acre in recent years have been greater than those during the earlier part of the experiment. If we take the average of all the varieties included in this test we find that the yield instead of decreasing has increased to a marked degree as the years have advanced. The soil on which these varieties have been grown has changed but little in fertility, and no plant selection has been used in this particular test. It, therefore, seems quite possible to grow the same varieties for a considerable length of time without change of seed, providing care is taken in the selection of the seed and in the growing of the crop.

Rotation of Crops.

One of the most difficult problems in handling land which is being devoted to experiments is to arrange the crops in such a way as to follow a reasonable and a satisfactory rotation. In order to arrange such a rotation the agricultural conditions of a district have to be carefully studied, and the various requirements of the experiments under way have to be taken into consideration. In order to get the crops to follow each other in such a way that all the essential features of a good rotation may be realized, and at the same time so that the rotation will fit in nicely with the experiments and will meet the sanction of the most progressive farmers is a difficult matter. After carefully considering this question the following rotation was adopted for the greater area of our experimental grounds: 1st year, grain; 2nd year, cultivated crops; 3rd year, grain; and 4th year, pasture. This rotation has given us about the right proportion of land for our experiments with grain and with cultivated crops, and it has appealed to the farmers as a reasonable rotation. There are a few principles which should apply to practically all rotations. Where practicable, every rotation should contain a nurse crop with which to sow the smaller seeds, a cultivated crop to assist in the liberation of plant food and in the

eradication of weeds, and a leguminous crop to obtain nitrogen from the atmosphere and to secure valuable fertilizing elements from the subsoil. In fact, it should be the aim to make every crop in the rotation help in the preparation for the crop which is to follow. The rotation used in the Experimental Department while not applicable under all conditions answers the requirements very well, indeed. The rotation of crops used on the farm proper also consists of four years, but is made slightly different so that it will better meet the needs of the stock requirements of the farm. The rotation referred to is as follows: 1st year, cultivated crops; 2nd year, grain; and 3rd and 4th years, hay and pasture. It will be seen by comparing these two rotations that they are quite similar with the exception that in the Experimental Department there are two years of grain, and one year of pasture, while in the farm proper there is one year of grain and two years of hay and pasture. It is probable that the rotation in the Experimental Department is slightly more severe on the land than that on the farm proper.

Some very interesting experiments have been conducted at the College in which winter wheat, barley and corn have been grown on clover sod in comparison with the same crop grown on timothy sod. As results of these experiments we found that the average increase in yield per acre of the crops following clover sod over those following timothy sod amounted to 44.7 per cent.

Influence of Seed Selection.

Extensive experimental work has been conducted at the College with the object of ascertaining definite information regarding the influence of different selections of seed on crop production. In extensive experiments which were reported in 1911 with grain crops, the results showed that in every instance, the large, plump seed gave a greater yield of grain per acre than small, plump, shrunken or broken seed. From a practical standpoint, it seems to be excellent practice, not only to sow clean seed grain that will be free from weed seeds, but to have the cleaning so thoroughly done that none but the very best seed is secured. When this practice is carried out, an important step has been made towards the obtaining of high yields of grain of superior quality.

Another experiment has been conducted for four years in succession in which both small and large sized seeds of each of four varieties of oats have been planted at seven different distances apart. The object of this experiment has been to endeavor to find out whether the maximum yield which could be obtained from large, plump seed would be different from the maximum yield which could be obtained from small, plump seed. From the results of the four years' experiment we learn that the maximum yields from the large, plump seeds have been greater than the maximum yields from the small, plump seed in about 90 per cent. of all the tests which have been made. We are obtaining some most interesting and valuable information from this experiment, and by the time it is conducted another year we will have the data of the five years' test, when we hope to present the results in more detail.

And still in another experiment which has been conducted at the College over a series of years in which heavy and light oats have been grown continuously in comparison with each other, the results are quite striking. The heavy oats have surpassed the light oats in appearance of grain, in weight of grain per measured bushel, and in yield of both straw and grain per acre. In 1912 the yield per acre of the large, plump oats was 74 bushels per acre, and from the light seed of the same variety, 53.9 bushels per acre.

A large amount of experimental work has been conducted at the College within recent years to determine the influence of different selections of root seed upon the resulting crop. Four tests were made annually with the different selections of seed of the field roots. Duplicate experiments were conducted in which the seeds of the different selections were planted separately, and duplicate experiments were also conducted by planting three large, five medium, and eight small seeds at each place where it was desirable for a root to grow. The plants were thinned to one at each place, and at equal distances apart. When the roots were harvested the yields of the duplicate tests of each method were averaged. The following table gives average results of the duplicate test made by means of each of two methods of comparison in order to ascertain the amount of influence of the size of root seeds on the yield of the roots produced:

Method of Planting.	Roots.	Number of years' tests.	Yield of crop per acre.		
			Large seed	Medium seed.	Small seed
			tons.	tons.	tons.
Plots in which equal numbers of seeds were planted separately.	Mangels	5	31.19	27.02	18.57
	Sugar Beets....	5	23.25	21.32	13.48
	Swede Turnips.	5	15.35	12.63	7.03
	Fall Turnips...	5	26.72	22.00	13.55
	Field Carrots ..	5	22.32	19.31	13.59
Plots in which equal numbers of plants were left when thinning.	Mangels	5	35.17	32.23	24.47
	Sugar Beets....	5	22.54	22.37	15.05
	Swede Turnips,	5	18.77	17.85	10.40
	Fall Turnips...	4	26.14	25.35	24.00
	Field Carrots ..	5	26.62	25.13	18.87

NOTE.—In the case of mangels and sugar beets the seed clusters instead of the separate seeds were used.

In the table here presented we have the average of no less than ninety-eight distinct experiments conducted with large, medium and small seeds of five distinct kinds of field roots. It will be noticed that in every instance the large seed produced greater yields than the medium sized seed, and that the medium sized seed produced greater yields than the small seed.

Influence of Plant Selection.

While it is true that we have obtained larger, more vigorous and more productive plants from large, plump seeds than we have from small, plump, shrunken or broken seeds of the distinct varieties with which we have experimented, we believe that for permanent results in plant improvement that the selection of the individual plants may furnish a greater influence on the crop production than the selection of the seed. We have done a considerable amount of work in plant selection at the College using in our nursery plots, in some instances, thousands of plants of the same variety, the seeds of which have been planted by hand at exact and uniform distances apart. As a result of this work we are now growing a number of selected strains of much prominence. The best known of these strains is the O. A. C. No. 21 Barley, and probably the next best known is the O. A. C. No.

72 Oats. Besides the selections already referred to important strains of hulless barley and spring rye have been recently distributed throughout Ontario for co-operative experiments, and the results so far are very satisfactory.

Influence of Cross-Fertilization.

A large amount of work has been carried on in recent years in the cross-fertilization of some of our most important varieties and strains of cereal crops, with the object of securing new varieties more suitable for Ontario than even the best of the named varieties which have been obtained through our extensive system of experimental work with about two thousand varieties. This work is so extensive that it is practically impossible to even give a summary of what has been done in this report. It is believed, however, that some valuable information is being obtained, and that some important new varieties of farm crops are being originated. We have in all, many thousand hybrids of our principal grain crops which we are carefully studying, and with which we are experimenting at the College.

Co-operative Experiments.

In 1912 the co-operative work of the Experimental Union was conducted on farms throughout Ontario in agriculture, forestry, agricultural chemistry, agricultural botany, apiculture, and in connection with the Public Schools in elementary agriculture, horticulture, and forestry. The co-operative work in Field Husbandry has been conducted for twenty-seven years, during which time there have been 68,329 distinct tests made throughout the Province. Each of these experiments consisted of from two to ten plots. The increase in the number of experimenters in agriculture can be seen from the following figures, which show the average yearly number actually engaged in the work in each of the five year periods during the last twenty-seven years, and also the number of experimenters in agriculture in 1911 and in 1912.

Five-year Periods.	Average number of Experimenters per annum.
1886—1890	71
1891—1895	1,060
1896—1900	2,992
1901—1905	3,379
1906—1910	4,278
1911	4,490
1912	5,027

This system of co-operative experiments in Ontario is exerting a marked influence on the agriculture of the Province. It is wholesome in its character, extensive in its operation, and far-reaching in its results.

Grains Used in Different Combinations for Grain Production.

While we are firm believers in the use of large, plump, sound seed, free from impurities, and of the very best varieties, we have been desirous of securing information as to the possibilities of certain definite combinations producing even

higher yields per acre than the individual varieties when sown separately. We have for years been conducting quite elaborate experiments at the College in which a number of different problems have been considered, which have a direct bearing on the growth of grains in various combinations. We believe that the results of these experiments have already had a marked influence in grain production in Ontario as there are now about one-half million acres used annually for the growing of grain from definite combinations of seed which have been sown by the farmers.

We have found as a result of our experimental work that of all the different combinations used, a mixture by weight of one bushel of barley and one bushel of oats has given the highest yield of grain, the yield being about 200 pounds of grain per acre more than could be obtained from either of the grains sown separately. In order to get satisfactory results from a mixture of this kind, however, it is necessary to use varieties which not only give good yields of grain per acre and furnish straw of good quality, but also varieties which will mature at about the same time. We have found that the Daubeney oats and the Mandscheuri barley answer admirably for this purpose. The Daubeney oats for this mixture might be replaced by the Alaska, the O.A.C. Yellow Sixty-day, or the O.A.C. Yellow Kherson varieties, and the Mandscheuri barley might be replaced by the O.A.C. No. 21. For a more detailed report of the results of the experiments in growing grains in mixtures for the production of either grain, green fodder, or hay, the reader is referred to the report for 1911, and also to other reports previous to that year.

Loose Smut in Oats and Stinking Smut in Wheat.

There is often a confusion on the part of the farmers in regard to the treating of grain for smut. The loose smut of barley, the loose smut of wheat, and the smut of corn cannot be effectually treated in the same way as either the loose smut of oats or the stinking smut of wheat can be treated. Some people treat their wheat effectually for the stinking smut, but are deceived in finding some heads of the loose smut appearing in the grain, and as a result think that the treatment was not effectual. This report deals with the treatment of the loose smut of oats, and the stinking smut of wheat, which are quite common in these crops and which can be effectually treated.

For five years in succession, experiments have been conducted at the Ontario Agricultural College for the prevention of the loose smut in oats and of the stinking smut in winter wheat. Careful determinations have been made each year to ascertain the comparative influence of the different treatments. There were in all seven treatments for oats and five treatments for wheat. In every instance one sample was left untreated as a basis for comparison. The experiment was conducted in duplicate both with oats and with wheat each year, there being two varieties of each class of grain used for the experiment. The following treatments were used throughout with the exception that numbers 3 and 6 were omitted from the treatments for the stinking smut in wheat:

(1) *Untreated.* One sample of oats and one sample of winter wheat of each variety were left untreated, in order that the influence of the various treatments might be observed.

(2) *Immersion in Hot Water.* For this treatment, the grain was placed in a bag which was then immersed in water at about 115 degrees F. Soon afterwards, it was placed in water which was kept at a temperature of between 130 degrees and 135 degrees F. The grain was occasionally stirred and was allowed to remain in

the water for a period of fifteen minutes. It was then spread out on a clean floor to dry, where it was stirred occasionally.

(3) *Immersion in Bluestone Solution for Five Minutes.* For this treatment a strong solution was made by dissolving one pound of copper sulphate (bluestone) in one gallon of water and then immersing the oats in the solution for a period of five minutes.

(4) *Immersion in Bluestone Solution for Twelve Hours.* In this treatment the bluestone solution was made by dissolving one pound of bluestone in twenty-five gallons of water, and the oats were immersed in this solution for a period of twelve hours.

(5) *Sprinkling with Bluestone Solution.* The solution was made by dissolving one pound of bluestone in ten gallons of water, which was used for sprinkling over the oats until they were thoroughly moistened after being carefully stirred.

(6) *Immersion in Potassium Sulphide Solution.* The potassium sulphide treatment consisted of soaking the seed for two hours in a solution made by dissolving eight pounds of potassium sulphide in fifty gallons of water.

(7) *Immersion in Diluted Formalin.* The solution of formalin (formaldehyde) used for the immersion process was made by pouring one-half pint of the formalin into twenty-one gallons of water, and the seed oats were immersed in this solution and stirred occasionally for a period of twenty minutes.

(8) *Sprinkling with Diluted Formalin.* One-half pint of formalin was poured into five gallons of water. The oats were then sprinkled with this solution and carefully stirred until the grain was thoroughly moistened.

After the treatments had been made for a few hours, the grains were carefully sown on separate plots, each of which was exactly twenty-five links long by twenty-five links wide. When the winter wheat was about ready to cut, it was carefully examined and the heads containing stinking smut were picked out and shelled. The rest of the crop was then threshed and again examined for the smut balls. When the oats were coming into head they were examined frequently and all smutted heads removed and carefully counted. The tables which follow give the average results in percentage of smutted grains of winter wheat and of smutted heads of oats in each of the five years during which each experiment was conducted. Besides this formation, the average yield of oats per acre for the five years and the average yield of winter wheat per acre for three years are included.

TREATMENT OF OATS FOR SMUT.

Materials.	Percentage of Smut.						Average yield of grain per acre. 5 years.
	1st year test.	2nd year test.	3rd year test.	4th year test.	5th year test.	Average of 5 years.	
							bus.
1. Untreated	5.5	3.9	11.6	4.3	3.4	5.7	60.3
2. Hot water	.0	.0	.0	.1	.0	.0	63.7
3. Bluestone—5 minutes	1.7	.9	.7	.6	.1	.8	58.5
4. Bluestone—12 hours	.6	.0	.0	.1	.0	.1	56.0
5. Bluestone—Sprinkled	.9	2.0	1.4	.6	1.6	1.3	61.8
6. Potassium Sulphide	3.4	.1	.3	1.5	.7	.2	66.2
7. Formalin—Immersed	.0	.0	.0	.0	.0	.0	68.3
8. Formalin—Sprinkled	.0	.1	.0	.0	.0	.0	61.3

TREATMENT OF WINTER WHEAT FOR SMUT.

Materials.	Percentage of Smut.						Average yield of grain per acre. 3 years.
	1st year test.	2nd year test.	3rd year test.	4th year test.	5th year test.	Average of 5 years.	
							bus.
1. Untreated	3.6	9.3	.6	.6	6.8	4.2	38.0
2. Hot water	.0	.0	.0	.0	.0	.0	40.6
3. Bluestone—12 hours	.0	.0	.0	.0	.0	.0	40.2
4. Bluestone—Sprinkled	.0	.2	.0	.0	.1	.1	41.1
5. Formalin—Immersed	.0	.0	.0	.0	.0	.0	43.3
6. Formalin—Sprinkled	.0	.0	.0	.0	.0	.0	36.3

The results of all the experiments show that the greatest yield of both winter wheat and oats per acre were produced from the grain which was immersed in a solution made by adding one pint of formalin to forty-two gallons of water for a period of twenty minutes. It will also be seen that this treatment was, in fact, the most effectual of all the treatments in completely preventing the trouble from the smut. Of the different bluestone treatments for smut in oats the most effectual was treatment No. 4, but that treatment, however, was not as satisfactory as the use of the formalin solution in which the grain was immersed. It will also be noticed that No. 3 and No. 4 treatments seemed to injure the germination of the grain slightly; they thus reduced the yield per acre. It will also be noticed that the sprinkling with the formalin treatment reduced the yield of winter wheat per acre, the average being nearly two bushels per acre less than the crop produced from the untreated seed. The results of all these experiments go to show the excellent satisfaction which has been obtained by immersing both oats and winter wheat for twenty minutes in a solution made by mixing one pint of formalin with forty-two gallons of water. This treatment is easily applied, comparatively cheap, effectual in killing the smut pores, and also effectual in producing the largest average yield of both wheat and oats per acre of all the treatments used.

In the spring of 1911, some varieties of oats were sprinkled with spores of the loose smut, after which they were sown without further treatment on plots located side by side. The Early Ripe variety proved to be practically immune to the attacks of the smut spores, while both the Black Tartarian and the Siberian varieties were quite badly infested with the loose smut in the crop of the past season. This is a further evidence that there is a marked difference in the different varieties as to their susceptibility to the attacks of smut.

At one time the writer considered that variety exerted but slight influence with regard to the amount of injury caused by the loose smut in oats or the stinking smut in wheat. From recent observations, however, it seems very evident that some varieties are decidedly more susceptible than others to the attacks of smut. During the years 1902, 1903, 1904 and 1905, we did not treat our varieties of oats for smut, but carefully picked out all smutted heads each year and kept an accurate record of the amounts of smut produced in the different varieties. The difference in the different varieties was very marked. In the spring of 1906, however, the varieties were all carefully treated by immersing the seed for twenty minutes in a solution made from one pint of formalin and forty-two gallons of water. In each of the past six years no treatment of the seed of these varieties has taken place. The following table gives the number of smutted heads taken from a plot 10 links wide by 100 links long from each of six different varieties of oats in each of the past eleven years:

Variety.	Number of Smutted Heads per Plot.										
	Before treatment.				After treatment.						
	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912
Early Ripe.....	0	0	3	0	0	0	0	0	0	0	0
Joanette	20	9	10	18	0	2	12	1	0	0	3
Siberian	32	43	78	20	0	1	0	0	5	0	1
American Banner..	116	303	317	22	0	3	2	4	5	0	2
Black Tartarian ..	332	608	369	62	0	3	12	15	29	25	16
Early Champion -..	634	380	1,244	166	0	11	9	5	6	12	4

The tabulated results here presented show in a very marked degree the differences in the varieties in their apparent susceptibility to smut and the effectuality of the treatment in destroying the smut which increases after treatment only slightly from year to year. When the oats are grown on one farm, however, and the threshing machine comes from another farm where the smut is very bad, it is almost sure to bring smut spores with it and thus to contaminate the oats, even though the seed has been treated in the spring previous. In order to keep the varieties of oats comparatively free from smut, therefore, it is necessary to treat occasionally and to watch carefully that smut spores are not introduced in considerable quantities from one farm to another.

While it is true that the amount of smut varies with the different varieties, it will also be noticed that there is a considerable difference in the amount of smut produced in different seasons. Some years the conditions are much more favorable for the development of smut than in other years.

The Early Ripe variety is the earliest oat amongst some two hundred and sixty varieties which we have grown in the experimental grounds, but the grain is long and slender, giving a rather light weight per measured bushel. From our experiments with this variety, it seems evident that it is immune to the attacks of smut. It is true that there were three smut heads found in 1904, but when it is considered that fully 17,000 grains of oats are sown in each plot, it is quite likely that the three smutted heads were all from one plant produced from a seed of some other variety which, by means of manure or some other way, got into the plot. We have introduced some spores with the seed of the Early Ripe variety before seeding, but have found the variety to be immune to the attacks therefrom. The resistance of some varieties to the attacks of smut shows the importance of further study along this line with the object of securing either through selection or through hybridization important varieties of oats and of wheat which may be practically immune to the attacks of smut.

Varieties of Spring Barley.

The market value of the barley of Ontario amounted to $12,000,154 in 1911, and the annual average value of this crop for the past five years was $11,212,274, and for the last thirty years $8,818,391. It will, therefore, be seen that the barley crop is a very important one in Ontario, occupying as it does about two-thirds million acres of land. In 1912 there were 19,232, 275 bushels of barley produced in Ontario. Those Counties of the Province which had the greatest number of acres devoted to this crop were as follows: Simcoe, 66,602; York, 39,382; Huron, 37,759; Grey, 33,584, and Wellington, 30,409.

According to the reports of the Bureau of Industries the yields of barley per acre in Ontario have reached thirty bushels or more in each of seven years, and these all occur since 1898. The highest and the lowest yields per acre from 1882 to 1898 were 29.2 bushels in 1891, and 21 bushels in 1893, and from 1899 to 1912, 34.3 bushels in 1903, and 26.3 bushels in each of the years 1911 and 1901. The yield of barley per acre in Ontario has been considerably increased in recent years as compared with former years, and this increase has undoubtedly been brought about to a considerable extent by the introduction of improved varieties such as the Mandscheuri at first, and the O. A. C. No. 21 more recently.

The three principal classes of barley which have been grown under experiment at Guelph are the six-rowed, the two-rowed, and the hulless varieties. Not only is there a marked difference in the three classes but there is also a decided difference in the varieties of each class, as for instance, of the six-rowed barleys some are bearded and some are beardless, and this also holds true with the hulless barleys. The hulless barleys are represented by both six-rowed and two-rowed varieties. The following table gives the average results of five years' experiments with each of twenty varieties of barley representing the three distinct classes, viz., six-rowed, two-rowed and hulless.

AVERAGE RESULTS FOR FIVE YEARS.

Classes and Varieties.	Bearded or bald.	Color of grain.	Average height.	Per cent. of rust.	Days to reach maturity.	Weight per measured bushel,	Yield per acre 5 years.	
							Straw	Grain
SIX-ROWED:			inches.			lbs.	tons.	bush.
Mandscheuri	Bearded	White	34	3	102	48.95	1.88	**69.49**
California Brewing	"	"	27	8	104	45.72	1.71	**63.66**
Oderbrucker	"	"	34	4	101	49.10	1.83	**62.56**
Common Six-rowed	"	"	33	4	99	49.18	1.81	**58.43**
Mensury	"	"	32	4	99	50.74	1.78	**57.88**
Zulu King	"	Black	26	8	101	48.72	1.59	**56.64**
Oregon	"	White	28	9	113	47.07	1.74	**51.10**
Success	Bald	"	32	5	93	45.44	1.47	**46.76**
TWO-ROWED:								
Imported No. 5591 (Iowa)	Bearded	White	31	4	108	51.78	2.09	**60.15**
Two-rowed King	"	"	32	4	106	51.37	1.97	**59.75**
Hanna No. 5590 (Iowa)	"	"	31	4	107	52.17	1.91	**57.93**
Jarman's Selected Beardless	"	"	30	5	109	52.22	1.84	**55.00**
French Chevalier	"	"	31	7	115	50.53	2.13	**46.63**
Two-rowed Canadian	"	"	30	9	111	51.02	1.93	**42.59**
Duckbill	"	"	30	9	111	50.15	1.81	**40.85**
HULLESS:								
Guy Mayle	Bearded	Green	25	4	97	59.64	1.78	**48.41**
Winnipeg No. 2	"	White	26	4	101	58.80	1.90	**46.00**
Purple	"	Purple	25	4	99	61.95	1.69	**45.87**
Black Hulless	"	Black	28	5	101	61.88	1.62	**45.23**
New White Hulless	Bald	White	26	9	106	58.83	2.12	**31.56**

The barley which is grown on the farms on Ontario is made up largely of the six-rowed varieties. Efforts were made by the Dominion Government about twenty years ago to introduce in an extensive way the two-rowed barley into Ontario the object being to grow a heavy barley which could be sold in England. The venture, however, did not succeed, and the two-rowed barley is grown only to a very limited extent in this Province. Although a very large number of varieties of barley which

gave comparatively low yields per acre have been dropped from our list after five years experiments it will be seen that there is still a marked difference in the relative productiveness of the different kinds. It should be understood that for both the six-rowed and the two-rowed varieties 48 pounds per measured bushel were used as the standard, but in the hulless barley 60 pounds per measured bushel were taken as the standard.

The Mandscheuri barley has occupied a very prominent place in barley growing in Ontario since its introduction by the College from Russia in 1889, and its distribution throughout Ontario a few years later. From the beginning it has continued to give good results, the average yield per acre per annum for the past twenty-three years being upwards of 71 bushels.

In connection with the Agricultural and Experimental Union the Mandscheuri barley has been distributed throughout Ontario in the past nineteen years to farmers who have applied for the experiment with barley. From these small lots so distributed the barley has increased over Ontario until it has been grown on upwards of half a million acres in a single year. The introduction of this barley has undoubtedly had a marked influence in increasing the yield of barley per acre throughout the Province, and in increasing the number of acres devoted to this important crop in Ontario. It is, however, being supplanted at the present time by the O.A.C. No. 21 barley, which is one of our own selections and which we wish to refer to particularly under a separate heading.

O. A. C. No. 21 Barley.

Anyone who wishes to make a study of barley growing in Ontario will undoubtedly find that the Ontario Agricultural College has been exerting a very marked influence, first, by the introduction, the testing and the distribution of the Mandscheuri barley from Russia, and second by the breeding, increasing and distributing of the O.A.C. No. 21 barley as a distinct variety. As we frequently receive enquiries regarding this barley it seems only proper to here give a brief statement regarding its origin. In the spring of 1903 selected grains of the Mandscheuri barley were planted by hand at equal distances apart in the Experimental Department at the College. When the plants were ripe they were carefully examined and thirty-three of the most promising ones were selected, harvested, and threshed separately. In 1904 these lots were sown separately in rows, and these rows were carefully examined and the most important ones were harvested and threshed. From that time forward only the best strains were grown in the tests as follows: 14 in 1905, 8 in 1906, 7 in 1907, and 3 in each of the past five years. During the first year the different strains went by number and the one which has proven to be the best is what is known as the O.A.C. No. 21. This variety was distributed throughout Ontario in connection with the Experimental Union, and has made a very excellent record. In each of four years in which it was compared with the Mandscheuri barley in the Co-operative experiments throughout Ontario it surpassed the latter in yield of grain per acre, in freedom from rust, and in both length and strength of straw. It is an easy matter to distinguish the grain of the O.A.C. No. 21 from that of the Mandscheuri variety. From the one pound lots of the O.A.C. No. 21 barley which have been distributed throughout Ontario this variety has been increased very rapidly over the Province. In 1911, and again in 1912 it has proven the most prominent variety in the competition of fields of standing grain in Ontario, and in connection with our largest exhibitions of threshed grain. In fact the O.A.C. No. 21 has captured practically all the prizes offered for

six-rowed barley at the largest competitions in each of the past two years. It is interesting to note that in the general class of six-rowed barley in connection with the Provincial Winter Fair at Guelph held in 1912 there were eighteen entries, and fourteen of these were for the O.A.C. No. 21, and three for the Mandscheuri, and of the ten entries of barley in connection with the standing field crop competition all were for the O.A.C. No. 21 with one exception, which was for the Mandscheuri.

Permit me to state that the history of both Mandscheuri and the O.A.C. No. 21 varieties of barley shows the practicability and the influence of the system of experimental work at the College, and of the co-operative experimental work in connection with the Experimental Union and its operations throughout Ontario. Through the medium of the co-operative experiments the farmers find out for themselves which varieties are most suitable for their own particular soils. The crop produced from the most promising variety can be carefully sown in the following year. In this way the variety can be rapidly increased not only to be used by the farmer himself, but also to be sold at an advanced price to his neighbors, to seedsmen, or to buyers at a distance. The co-operative experiments not only forms an excellent medium through which to introduce leading varieties, but it has many features of educational value which we believe are exerting a very wholesome influence on the Agriculture of our Province.

Varieties of Winter Barley.

In each of the past six years two varieties of winter barley have been grown under test at the College. The results of these two varieties, however, were very similar. One variety of winter barley has been grown at the College for nineteen years. In each of four years it was badly winter-killed, and in the other fifteen years it produced an average yield of 54.8 bushels of grain per acre, which weighed on an average of 47.8 pounds per measured bushel. Winter barley is somewhat less hardy than winter wheat in Ontario.

Varieties of Oats.

In the average of the past thirty-one years there have been grown in Ontario annually 2,231,994 acres of oats which have given an average yield per acre of 35.6 bushels. It will, therefore, be seen that the oat crop in Ontario is an exceedingly important one. The market value of the crop in 1911 was $37,494,695. Anything which could be done to increase the value of oats one dollar per acre in Ontario would increase the money value of this crop by over two and one half million dollars.

Realizing the great importance of the oat crop in Ontario a considerable amount of attention has been given at the College to the testing of different varieties and to the starting of new strains through selection, and by the creating of new varieties through hybridization. About three hundred varieties of oats have been carefully tested in the Experimental grounds, but many of these have been dropped after they have been grown for five years in succession, owing to the fact that other varieties have proven more successful. Each year a few new varieties are added and a few of the inferior ones are dropped. It is the intention in this report to deal more particularly with the comparative results of the different varieties which have been under experiment. In 1912, 105 varieties, selections and hybrids were under test. Of these 37 named varieties have been under experiment in each of five years. The following table gives the average results for the five year period of each of the 37 named varieties which have been under test for that length of time:

Varieties of Oats.	Per cent. Hull. five years.	Average Result for Five Years.						Yield of grain per acre.	
		Heads, mane or spreading.	Days to mature.	Height.	Per cent. rust.	Weight per measured bushel.	Straw per acre.	1912.	Average five years.
				ins.		lbs.	tons.	bushels.	bushels
O.A.C. Yellow Sixty-Day	27.9	S	100	39	7	32.34	1.79	120.50	**92.24**
" " Kherson..	26.4	S	101	37	5	31.76	1.79	107.50	**92.13**
" White Sixty-Day	29.3	S	106	42	12	32.84	1.96	95.82	**87.51**
Peerless	28.1	S	110	43	14	32.72	2.25	103.91	**83.81**
O.A.C. White Kherson	27.3	S	107	41	14	32.73	2.04	95.26	**83.44**
Siberian	29.3	S	108	42	10	31.73	1.77	99.53	**82.82**
Minnesota No. 26	28.7	S	109	43	13	32.40	2.12	93.38	**82.41**
Iowa Silver Mine	30.0	S	107	42	12	33.00	1.92	88.88	**81.40**
Early Champion	28.0	S	108	43	12	32.98	2.09	89.68	**80.69**
Prosperity	27.3	S	106	42	11	33.52	1.91	86.18	**80.17**
Probsteier	27.7	S	108	42	12	33.59	1.98	91.26	**79.55**
Great Dane	29.0	S	112	41	14	31.27	2.20	109.15	**79.51**
Daubeney	25.0	S	103	39	8	34.57	1.76	76.47	**78.58**
Alaska	24.9	S	103	42	9	35.67	1.81	83.41	**77.25**
Oderbrucker	30.1	S	110	43	15	32.94	2.22	80.47	**75.96**
New Sensation	27.4	S	108	42	13	33.92	1.95	88.74	**75.71**
Liberty	29.5	S	111	41	13	32.17	2.02	106.44	**74.89**
Newmarket	27.9	S	108	43	14	34.23	1.80	88.41	**74.65**
Myrick	28.4	S	109	42	12	33.36	1.91	80.94	**74.38**
Ligowa Hafer,	27.3	S	109	42	12	34.37	1.90	87.97	**74.04**
New Zealand	29.2	S	110	41	12	31.25	2.05	98.06	**73.74**
Waterloo	26.9	S	110	42	12	32.11	2.13	82.62	**73.22**
Abundance	28.0	S	108	41	11	33.83	1.76	74.59	**72.51**
English Glory	27.8	S	108	41	11	34.09	1.86	90.09	**71.74**
Joanette	24.3	S	107	38	8	32.66	2.05	67.91	**70.82**
Pioneer	36.3	S	109	39	17	32.83	2.21	91.03	**70.78**
Early Ripe	25.9	S	98	39	7	29.70	1.66	59.65	**70.18**
Bavarian	28.3	S	110	42	10	33.59	2.20	88.47	**69.37**
Yellow Russian	28.1	S	109	40	10	33.35	1.78	90.29	**68.60**
Vick's American Banner.	30.9	S	110	42	9	32.91	1.92	73.44	**66.28**
Tartar King	33.2	M	108	44	13	33.79	1.92	82.29	**65.42**
Egyptian	30.7	M	110	42	15	34.28	2.20	66.38	**65.02**
Storm King	33.8	M	108	40	16	33.12	1.98	87.41	**63.70**
Early Dawson	34.9	S	104	45	12	36.09	2.18	54.50	**62.92**
White Superior Scotch..	35.1	S	104	46	12	36.76	2.08	51.62	**57.90**
Black Tartarian	30.9	M	114	41	20	28.95	2.19	60.79	**57.73**
Hulless Oats	.....	S	108	45	9	.....	2.55	42.82	**43.23**

The results of the experiments with the different varieties of oats are exceedingly interesting, showing great variations in nearly all characteristics. Although many varieties have been dropped from the list, still those which are under test give a wide range for selecting the variety most suitable for the farmer to grow. Oats are very deceiving. The best variety for the farmer to grow on his farm is not necessarily the variety which takes the highest prize in the field crop competition, nor yet the variety which makes the highest record in the exhibit of threshed grain, nor yet the variety which occupies the highest place in both of these competitions. In order to find out the real value of an oat it is necessary to grow the different varieties under similar conditions, and make a definite comparison of all the important characteristics. It is interesting to note that some of the varieties which stand the highest in both yield and quality of grain are not varieties which make a particularly good showing in the field or at the exhibition.

Probably this statement would shock many of our best farmers, and yet there is much truth in the statement. Our results also give justification for another statement which is probably even more unorthodox than the last, and that is, that those varieties of oats which weigh the most per measured bushel are, as a rule, light yielders and of poor quality. In justification of these statements I would refer the reader to a careful study of the results presented in the accompanying table. In this connection I would particularly draw attention to the results given under the per cent. of hull, weight per measured bushel, and average yield of grain per acre. The O. A. C. Yellow Sixty-Day variety of oats gave an average of 92 bushels per acre, which had less than 28 per cent. of hull, but these oats gave an average of only 32.3 pounds per measured bushel. In comparison with these results kindly observe that the White Superior Scotch gave less than 58 bushels of grain per acre, which had fully 35 per cent. of hull, although the oats weighed nearly 37 pounds per measured bushel on an average for the five year period. Each of the seven highest yielding varieties had less than 30 per cent. of hull, and each of the seven lowest yielding varieties had upwards of 30 per cent. of hull. Each of the seven highest yielding varieties weighed less on the average than 33 pounds per measured bushel, and five of the seven lowest yielding varieties weighed upwards of 33 pounds per measured bushel. It will be noticed that there are only four varieties of oats with a mane or spreading head, and that each of these four varieties occupy a very low place in average yield of grain per acre. We have never yet found a particularly high yielding mane oat. Those varieties of oats, which have the mane or side heads, give appearance of high yielders when growing in the field, but usually give low yields when the actual results are determined.

In selecting a variety of oats to mix with a medium maturing barley, such as the Mandscheuri or the O. A. C. No. 21, in order that they may grow and ripen together satisfactorily, it is necessary to select an early variety of oats. For this purpose the Daubeney and the Alaska have given excellent results. The improved strains of the Sixty-Day and the Kherson varieties may prove very important for this purpose.

The O. A. C. Yellow Sixty-day Oats and the O. A. C. Yellow Kherson Oats.

In the spring of 1906 we sowed for the first time some seed of the Yellow Kherson and of the Sixty-day varieties of oats. This seed was obtained from the Agricultural College of Kansas. Both of these varieties had been giving good results. In the first year's trial at Guelph we found that both samples were badly mixed. We, therefore, made a very careful seed selection by using only the largest and plumpest yellow seeds, and also of the largest and plumpest white seeds of each variety. These selections were sown on four separate plots and have been carefully selected and tested up to the present time. It will be seen from the table here presented that the O. A. C. Yellow Sixty-day Oats and the O. A. C. Yellow Kherson oats now head the list of the named varieties grown under test in each of the past five years. The O. A. C. White Sixty-day and the O. A. C. White Kherson varieties occupy third and fifth place in the comparative results. It will be seen that the yellow varieties are six days earlier than the white varieties. Although the O. A. C. Yellow Sixty-day oats are very early and heavy yielders, and are comparatively thin in the hull, it must be remembered that the hull of the

grain is yellow in color and is not so plump, and not as attractive in appearance as some of the other varieties, such as the New Sensation, the Abundance, the Banner, the Storm King, and the Early Dawson. The O. A. C. Yellow Sixty-day and the O. A. C. Yellow Kherson varieties are very similar in all characteristics, and in average yield of grain per acre for the five years there is a difference of only about one-tenth of a bushel. These varieties are not only heavy yielders of grain of good quality, but they are very early in reaching maturity, and are suitable for mixing with the Manscheuri, or the O. A. C. No. 21 Barley, when it is desirable to grow these varieties in combination.

The O. A. C. No. 72 Oats.

It seems proper at this time to give special attention to a new oat which originated at the College through selection. This oat has made an excellent record at the College, and in one year in which it was tested in the co-operative experiments throughout Ontario, it took the lead in yield per acre throughout the Province and was very popular with the experimenters.

The variety of oats known as the O. A. C. No. 72 was started from a single plant selected from over nine hundred plants of the Siberian variety of oats which was grown in a nursery plot. Its history has been somewhat similar to that of the O. A. C. No. 21 barley, and it may occupy a somewhat similar position amongst the varieties of oats as the O. A. C. No. 21 has amongst the varieties of barley. It is an oat which has given very good straw both in length and in strengh. The yield of grain has been large and the percentage of hull below the average.

The Stooling Character of Oats.

Experiments have been continued in 1912 in the further study of the stooling properties of oats. There has been considerable amount of discussion recently in regard to the advisability of growing what are termed non-stooling varieties of oats. As the results of investigations on the influence of the stooling of grains appeared very meagre, we thought it wise to start some experiments, with the object of trying to obtain some definite information on this important question. While it is true that the stooling of the grains is influenced by the fertility of the soil, the conditions of the weather, etc., it is also true that it is influenced by the variety of the grain and by the thickness of the sowing. The fertility of the soil, the thickness of the sowing, and the varieties used are largely under the control of the farmer. The stooling or the tillering of the grain crops forms an exceedingly important subject for study and investigation. In the results of our own experiments in each of the past four years the varieties of oats have shown very marked influences in stooling properties. We here present the average of four years' results of each of a number of varieties of oats which were sown under uniform conditions:

Varieties.	Average number of stools per plant (4 years)
Joanette	20
Burt	18
Abundance (Regenerated)	17
Early Ripe	17
Yellow Kherson	17
Daubeney	15
Sixty Day	14
American Banner	14
Siberian	12
Storm King	8
Tartar King	7

The seed of the varieties here mentioned was sown in rows one foot apart, and the plants were allowed to stand one foot apart in the rows, so that all of the plants would have a good opportunity for the development of stools, and thus bring out the characteristics of the different varieties in this respect. It will be seen that there is a variation in the average number of stools, from seven in the case of the Tartar King, to twenty in the case of the Joanette. The average number of stools per plant varied rather more than usual in 1912, there being eight for The Tartar King and twenty-six for the Joanette. The increase in the number of stools per plant for the past year was undoubtedly due, to a certain extent, to the cool, wet season. The introducers of the Regenerated Abundance variety of oats claimed that it was necessary to sow this variety at the rate of four bushels per acre in comparison with two bushels of oats per acre of the Siberian, owing partly to the fact that the Abundance was a light stooling variety. We find, however, that in the average of the four years' experiments the Regenerated Abundance has had an average of three stools per plant more than the Banner, and has had more than double the amount of stools per plant as compared with either the Storm King or the Tartar King, two varieties which were introduced by the same firm. In looking over the results of the individual plants for 1912, it is noted that the number of stools of the Tartar King variety varied from 5 to 14, and that of the Joanette variety from 13 to 36.

In each of the past four years an experiment has been conducted in our experimental plots by planting the seed of each of four varieties of oats at different distances apart. No less than ninety plots were used for this experiment in each of the past four years. We are not yet prepared to give the details of this experiment, but hope to be able to do so after we have had the results for another year. It might be stated in a general way, however, that those varieties of oats which are heavy stoolers appear to adapt themselves to varying conditions better than those which are very light stoolers.

Special Consideration of the Hull of Oats.

It seems strange that so little attention has been given to the percentage of hull in the oats. Some of the varieties which have been most strongly recommended in recent years are exceedingly thick in the hull. As the average percentage of hull of the varieties of oats grown at the College for five years varied from 24.3 to 36.3, it will be seen that there is a difference of exactly 12 in the percentage of hull of these two varieties. The two kinds of oats which are the extreme in this respect are both black varieties, and stand side by side in average

yield of grain per acre, varying only about one pound per acre per annum, and this variation is in favor of the thinnest hulled variety. When we consider that a difference of three per cent. in the amount of hull, if applied to the oat crop of Ontario, would mean over one million dollars annually to the value of the oat crop in this Province, we might be able to realize, to a certain extent, the importance of this question. We, therefore, feel justified in recommending to the reader a careful study of the average results of the percentage of hull, as given in the tabulated results of all the varieties reported in the preceding table. In order to draw more particular attention to this question, and to enable the reader to see that the differences in percentage of hull are differences in variety, and are not mere chance work, we submit the detailed results of four varieties for each of eleven years, which are as follows:

Varieties.	Percentage Hull.											
	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	Ave. 11 yrs.
Joanette	22.5	23.1	22.5	24.0	25.2	23.4	23.9	25.4	23.9	23.9	24.3	**23.8**
Daubeney	26.1	25.1	23.0	26.3	26.3	24.7	23.8	25.4	24.9	26.2	24.6	**25.1**
Early Dawson.	32.6	33.7	32.4	36.0	38.1	33.7	36.6	36.8	31.4	34.1	35.8	**34.7**
Pioneer	48.1	36.8	36.9	36.8	42.8	38.8	37.4	36.7	33.5	36.8	37.0	**38.3**

From a study of the foregoing table it will be seen that with only two or three exceptions the same order of the varieties of oats in regard to hull production was followed in each of the ten years. The Joanette and the Daubeney were thin-hulled varieties in every case, the highest percentage of either variety in any one year being 26.3. In comparison with these the Early Dawson and the Pioneer varieties produced thick-hulled oats in every instance, the lowest percentage of either variety being 31.4, or practically five per cent. greater than the highest percentage of the two thin-hulled varieties. It will also be noticed that there is a variation in the thickness of the hull from 22.5 for the Joanette in 1902 to 48.1 for the Pioneer in the same year. From a study of the longer list of varieties of oats it will be seen that the two thin-hulled varieties surpassed the two thick-hulled varieties in yield per acre, and that the average of the Daubeney was 78.6 bushels per acre per annum, and that of the Early Dawson 62.9, or a difference of nearly sixteen bushels per acre per annum in favor of the thin-hulled, as compared with the thick-hulled variety.

Species and Varieties of Wheat.

Not only are there a number of different varieties of wheat grown in Ontario, but there are representatives of at least three different species of wheat grown considerably in different parts of the Province. This being the case it seems proper to here state the different species of wheat which are usually given in the botanical classification of this important crop. While authorities differ slightly in regard to the classification, the one which we here present is, perhaps, the simplest, and the one which has been frequently adopted. The seven different species are as follows:

(1) Common, fine, or soft wheat (*Triticum vulgare*).
(2) Turgid, or toulard wheat (*T. turgidum*).
(3) Hard, or flinty wheat (*T. durum*).
(4) Polish wheat (*T. polonicum*).
(5) Spelt (*T. spelta*).
(6) Emmer, or starch wheat (*T. dicoccum*).
(7) One-grained wheat (*T. monococcum*).

Of the seven different types of wheat here presented, the one mentioned first in the list is decidedly the most common in this Province. To this species belongs the greater number of both the spring wheats and the winter wheats; some of which have bearded, and others beardless heads. Some have red and others white chaff, and some are red wheats, and in others the grain is classed as white or amber. Such well-known varieties as Dawson's Golden Chaff winter wheat and Red Fife spring wheat belong to this type. The third species referred to in the foregoing list is represented in Ontario by the Wild Goose spring wheat, which is grown quite extensively in many parts of the Province. Emmer is grown to a limited extent in some sections of the Province under the name of Common Emmer, but in some sections the same grain is improperly called Spelt.

For a report of this kind it seems wise to present the results of the experiments with wheat, not from a botanical classification, but rather from a popular classification, into which the wheats readily arrange themselves. The results will, therefore, be discussed under the following headings: Varieties of Winter Wheat, Varieties of Spring Wheat for flour production, Varieties of Macaroni Spring Wheat, Emmer and Spelt for the production of grain for feeding purposes, and Wheat of other species.

Varieties of Winter Wheat.

About two hundred and seventy varieties of winter wheat, and also a large number of crosses and selections, have been grown under experiment at the Agricultural College within the past twenty-three years. Nearly all of the varieties have been carefully tested in each of five years, after which the inferior kinds have been discarded, and those which have given the best results have been continued in the experiments. In the last year, eighty-five different lots of winter wheat were carefully tested under uniform conditions. These included thirty-four named varieties, twenty-four hybrids and a number of straight selections. Of the named varieties, eleven have been grown for less than five years, and twenty-three varieties for five or more years. As fourteen varieties of winter wheat have been grown in each of the past seventeen years, the results of these are of special value. The following table gives for each of these fourteen varieties the average weight per measured bushel for sixteen years, the yield of grain per acre for 1912, and the average yield of both straw and grain per acre for the seventeen year period:

RESULTS OF VARIETIES OF WINTER WHEAT.

Variety.	Color of Grain.	Pounds per Measured Bushel. 16 years.	Yield per Acre.		
			Bushels Grain 1912.	Average 17 Years.	
				Tons Straw.	Bushels Grain.
Dawson's Golden Chaff	White	60.1	22.2	3.0	52.2
Imperial Amber	Red	60.9	30.8	3.3	48.1
Early Genesee Giant	White	60.1	13.2	3.1	47.7
Early Red Clawson	Red	58.9	15.5	2.9	46.8
Egyptian Amber	Red	61.7	31.5	3.3	46.7
Rudy	Red	61.4	23.1	2.8	45.3
Tasmania Red	Red	61.7	31.8	2.9	44.1
Geneva	Red	62.3	24.2	3.0	43.9
Kentucky Giant	Red	61.1	15.5	2.8	43.6
Turkey Red	Red	61.1	12.0	2.8	43.3
Tuscan Island	Red	61.0	23.4	2.9	43.3
Treadwell	White	60.1	10.3	2.8	42.4
Bulgarian	White	60.6	14.2	2.8	42.3
McPherson	Red	61.7	15.1	2.7	41.9

The average results of the fourteen varieties are as follows: yield of grain per acre, 20.2 bushels for 1912 and 45.1 bushels for the seventeen year period; yield of straw per acre, 1.3 tons in 1912 and 2.9 tons for the seventeen year period; and weight of grain per measured bushel, 55 lbs. for 1912 and 60.9 lbs. for the sixteen year period. These results show that in the experiments at the College for 1912, the winter wheat gave a yield of grain per acre less than half the annual average for the past seventeen years. They also show that for weight per measured bushel the average for this year is 5 lbs. below the standard and 5.9 lbs. below the average for the past seventeen years. In the last seventeen years, the lowest average yields per acre of the fourteen varieties mentioned have been as follows: 1912, 20.2 bus.; 1895, 28.3 bus.; 1908, 32 bus.; and 1904, 34.1 bus.; and the highest yields were produced in 1900, 66.7 bus.; 1902, 61.6 bus.; and 1903, 60.5 bus. In 1899 and in 1901 the results were so poor that no satisfactory tabulated returns could be made. These results will show that the yields in 1912 are unusually low.

The Dawson's Golden Chaff winter wheat is still grown more extensively in Ontario than any other variety. It will be seen that it has given the highest yield of grain per acre of the fourteen varieties which have been grown at the College in each of the past seventeen years. It produces a very stiff straw of medium length, beardless heads with red chaff, and white grain which weighs about the standard per measured bushel. The grain of the Dawson's Golden Chaff, which was formerly quite soft, appears to be improving somewhat in quality for bread production. The Imperial Amber variety produces a large amount of straw which is somewhat weak, a bearded head with red chaff, and a red grain of very good quality. The Early Genesee Giant has a compact bearded head, and a grain which is sometimes classed as white and sometimes amber. The Early Red Clawson variety has a comparatively weak straw and grain of poor quality.

Twenty-eight varieties of winter wheat grown in 1912 have been under experiment for at least five years. In the five years' test, the highest yields in bushels of grain per acre of the named varieties have been produced by the American Banner, 44.7; American Wonder, 42.6; Dawson's Golden Chaff, 42.4.

and Abundance, 42.1. These four varieties are all of the Dawson's Golden Chaff type and resemble each other closely in their various characteristics. The largest yields in bushels of grain per acre of varieties of other types in the five years' experiments are as follows: Crimean Red, 40; No. 5 Red, 39.9; Rudy, 39.1; Michigan Amber, 38.8; Alberta Red, 38.3; Kentucky Giant, 38.3; Banatka, 37.7; Scott, 37.2; Early Genesee Giant, 37.2; and Imperial Amber, 36.9. The heaviest weights of grain in pounds per measured bushel in the five years' test have been produced by the Northwester, 62.5; Alberta Red, 62.5; Egyptian Amber, 62.4; Rudy, 62.4; Geneva, 62.1; Michigan Amber, 61.8; Tasmania Red, 61.8; Nigger, 61.7; and Imperial Amber, 61.5.

Of the thirty-nine named varieties of winter wheat grown in 1912, the greatest yields of grain per acre were produced by the Yaroslaf, 42.4 bushels; Kharkov, 36.7 bushels; Tasmania Red, 31.8 bushels; Egyptian Amber, 31.5 bushels; Grand Prize, 31.5 bushels; Imperial Amber, 30.8 bushels; Theiss, 30.5 bushels; Virginia Miracle, 29.5 bushels; and Michigan Amber, 29.3 bushels. It is interesting to note that these are all red wheats with bearded heads which withstood the unusually severe weather conditions better than the beardless white varieties.

The weather conditions of the past winter and spring were unusually severe for winter wheat. Some of the varieties were killed badly, and others came through fairly well. Careful notes were taken of the percentage of living plants on the 10th of May, and it was found that of the fourteen lots which survived the winter the best, four were distinct varieties, five were special selections of our own, and five were hybrids obtained by crossing different varieties at this institution. The four varieties which survived the winter better than any others were the Yaroslaf, Tasmania Red, Dawson's Golden Chaff, and Grand Prize. The five most hardy selections were three from the Dawson's Golden Chaff, and two from the Imperial Amber, and the five hardiest hybrids were crosses between the Dawson's Golden Chaff and the Tasmania Red, and the Turkey Red. It is interesting to note that out of the fourteen different lots which survived the winter the best ten of them were selections and hybrids each of which proved to be more hardy than any one of thirty named varieties.

In each of the past five years, the varieties of winter wheat grown in the Experimental Department have been carefully tested for bread production in the Bakery Branch of the Chemical Department at the College. The varieties of winter wheat which produced the largest loaves of bread from equal quantities of flour in the average of the tests made in the five years are as follows: Banatka, Crimean Red, Yaroslaf, Tuscan Island, Rudy, Treadwell, Tasmania Red, Buda Pesth, Egyptian Amber, Kentucky Giant, and Michigan Amber.

The plant breeding work at the College has included winter wheat as well as the spring crops. A considerable amount of work has been done at the College during the last few years with the object of improving some of the best varieties of winter wheat by means of systematic selection and by cross-fertilization. The Dawson's Golden Chaff has been used extensively for crossing with such varieties as the Tasmania Red, Crimean Red. Buda Pesth, Turkey Red, and Imperial Amber. One hybrid gave a yield of 55.2 bushels per acre, which was the highest yield produced at the College this year. Two of our own selections of the Dawson's Golden Chaff gave upwards of fifty bushels per acre. These hybrids and selections, however, have not as yet been sufficiently tested and grown in large enough quantities for distribution. We expect to increase the supply of seed of one selection and one hybrid this coming year.

Varieties of Spring Wheat for Flour Production.

Of the 123,080 acres of spring wheat in Ontario last year the following counties grew the largest areas: Renfrew, 32,314; Ontario, 5,899; York, 5,583; Simcoe, 5,506, and Victoria, 5,113. There is but little spring wheat grown in the southwestern part of the Province. The average yield of spring wheat per acre throughout Ontario in 1912 was 18.7 bushels, which is one-and-one-half bushels per acre more than in the year previous, and fully two bushels per acre more than the average of the past thirty-one years.

Not only have we had under experiment the different varieties of spring wheat obtained in Ontario, but we have imported other kinds from various countries of the world, and have tested them under similar conditions with those which have been grown in this Province. The following table gives the average results of five years' experiments with each of the fourteen varieties of spring wheat grown at the College:

Average Results of Spring Wheat for Five Years.

Varieties.	Bearded or Bald.	Color of grain.	Average height.	Per cent. rust.	Days to reach maturity.	Weight per measured bushel.	Yield per acre.	
							Straw. tons.	Grain. bus.
			(ins.)					
Red Fife	Ba.	Red	41	9	119	58.97	1.75	**31.93**
Climax	Be.	Red	43	8	118	59.68	1.78	**31.78**
Saxonka	Be.	Red	44	8	119	59.88	1.79	**31.54**
Minnesota No. 163	Ba.	Red	41	8	118	58.85	1.82	**30.91**
Wellman Fife	Ba.	Red	41	9	119	58.99	1.79	**30.31**
Hungarian	Be.	Red	38	6	114	61.04	1.81	**30.06**
Pringle's Champion	Be.	Red	43	8	119	59.95	1.67	**29.57**
Carleton	Be.	Red	43	9	119	59.91	1.77	**29.47**
Red Fern	Be.	Red	42	8	118	60.33	1.67	**28.70**
White Russian	Ba.	Red	40	8	120	59.04	1.71	**28.10**
White Fife	Ba.	White	38	8	121	58.33	1.64	**27.74**
Herison Bearded	Be.	Red	41	7	119	61.15	1.77	**27.03**
Colorado	Be.	Red	41	7	115	59.58	1.60	**25.89**
Preston	Be.	Red	40	7	116	58.76	1.45	**25.46**

It will be observed that there is an average annual difference in yield of grain per acre of about six and one-half bushels between the highest and the lowest yielding varieties. The Red Fife which has been grown so long in Ontario occupies the highest place in yield per acre for the five year period. It will be observed, however, that six separate varieties have given a yield of upwards of thirty bushels per acre. Seven of the varieties of spring wheat have been grown at the College for twenty-three and twenty-four years in succession without change of seed from any outside source. One of these varieties occupies the highest and another the lowest yield per acre in the average results for the past five years as presented in the accompanying table. In 1912 the greatest yield per acre was obtained from the Marquis wheat. This wheat was obtained from Dr. C. E. Saunders, Central Experimental Farm, Ottawa. It is a hybrid wheat originated by Dr. Wm. Saunders, and afterwards selected and distributed by Dr. C. E. Saunders. It is a very early wheat and is apparently of excellent quality. Within the last few years it has made a high record in some of the Western Provinces.

Varieties of Macaroni Spring Wheat.

Many farmers in Ontario have grown the Wild Goose variety of spring wheat and have known that it was different in several respects from the ordinary spring wheat, but did not realize that it belonged to a distinct species known as the durum or macaroni wheat. The durum class of wheat is grown quite extensively in some countries for the manufacture of macaroni. The Wild Goose, which is the most common variety of this class grown in Ontario is some times exported to Southern Europe for the manufacture of macaroni, but is being much more extensively used in Ontario for flour production than formerly. Although it requires more power to convert the macaroni wheat into flour than is required by most of the other varieties, the millers are realizing that it is a wheat of good quality, and that a small portion of this wheat will improve the strength of the flour made from the winter wheat grown in Ontario.

Each of three varieties of macaroni wheats have been grown in the Experimental grounds for twenty years in succession, and the following table gives the average results of the weight per measured bushel, and yield of straw and grain per acre for that period:

Average Results of Durum Wheats for Twenty Years.

Varieties.	Weight per measured bushel.	Yield per acre.	
		Tons of straw.	Bushels of grain.
	lbs.		
Wild Goose	61.10	2.1	37.2
Medeah	59.79	2.1	33.8
Sorentina	59.26	2.2	32.0

It will be seen that the Wild Goose wheat has given the highest yield of grain per acre of the three varieties of Macaroni wheat grown for twenty years. The following table, however, which gives the average results of five years' experiments of each of seven varieties of macaroni wheats shows that the Wild Goose variety is surpassed by three other sorts:

Varieties.	Average Results for 5 years.				Average Results for 5 Years.		
	Bearded or Bald.	Average Height.	Per cent. of Rust.	Days to to Reach Maturity.	Weight per Measured bushel.	Yield of Straw per Acre.	Yield of Grain per Acre.
		ins.			lbs.	tons.	bush.
Roumania	Be.	44	6	118	61.28	2.14	**35.20**
Arnautka (1537)	Be.	44	5	118	61.23	2.08	**33.77**
Kubanka	Be.	45	8	117	60.54	2.08	**32.69**
Wild Goose	Be.	43	12	120	59.18	2.09	**31.22**
Medeah	Be.	45	4	113	58.09	1.93	**30.58**
Iumillo	Be.	38	11	115	59.82	2.00	**26.47**
Sorentina	Be.	46	9	116	58.16	2.11	**26.27**

In the five years' test the Wild Goose variety has been surpassed by the Roumania wheat by an average of four bushels per acre per annum. The Wild Goose, Medeah, and Sorentina hold the same relative position in yield per acre for the five year and for the twenty year periods.

Emmer and Spelt for the Production of Grain for Feeding Purposes.

It will be seen from a reference under the heading "Classification of Wheat" that Emmer and Spelt are two distinct species. Although both Emmer and Spelt have been grown at the College more or less for over twenty years the last named grain is scarcely ever grown on the farms of Ontario. Emmer has been grown as a field crop in many sections although it is usually improperly called Spelt. Each of these two types of wheat are represented by a number of varieties. The chaff of both varieties closely surround the kernels, and when the grain is threshed the most of it still remains in the chaff. The grain along with the chaff is usually ground into meal for feeding to farm stock. The following table gives the average of eleven years' results of each of three varieties of Emmer and three varieties of Spelt which have been grown at the College:

Classes of crops.	Varieties.	Average results for 11 years.			Weight per measured bush. average of 10 years. lbs.	Average results for 11 years.	
		Per cent. rust.	Per cent. of crop. lodged.	Per cent. of hull.		Straw per acre. tons.	Grain per acre. lbs.
Emmer	Common	3	29	21	39.6	2.0	2,833
	Russian	2	24	21	39.9	1.8	2,706
	Iowa	3	23	20	39.9	1.8	2,656
Spelt	Red	12	3	29	27.6	1.6	2,016
	Alstroum	15	3	30	27.6	1.6	1,991
	White	14	3	30	27.2	1.5	1,841

The results presented in the foregoing table are very interesting and quite suggestive. In every instance the Emmer has surpassed the Spelt in yield of grain per acre, the lowest yielding Emmer surpassing the highest yielding Spelt by over six hundred pounds of grain per acre per annum. The highest yielding Emmer has surpassed the lowest yielding Spelt by nearly one thousand pounds of grain per year. It will also be observed that in weight per measured bushel the varieties of Emmer are much heavier than those of the Spelt. Not only do the varieties of Emmer yield more per acre and weigh more per measured bushel than the Spelt, but the grain is also very much thinner in the hull and the straw is decidedly less subject to the attacks of rust. It will be noticed, however, that the Spelt possesses stiffer straw than the Emmer in the case of each of the varieties under experiment. In experiments which have been conducted at some of the Experiment Stations in the United States Emmer has given results about equal to barley for feeding purposes. The reader will naturally come to the conclusion that while Spelt gives very unsatisfactory results in Ontario the Emmer has made a good showing in the experiments at the College. It might be here mentioned also that the results from the growing of Emmer in the co-operative experiments throughout Ontario have been very good, as this grain has formed a close rival in productiveness to the best varieties of oats and to the best varieties of barley.

One variety of Winter Emmer has been grown at the College in each of the past five years. In the four years previous to 1912 the yield of grain amounted to about 2,500 pounds per acre per annum, but in the past year the crop was very badly winter-killed.

A Comparison of Four Species of Spring Wheat.

It seems necessary, sometimes, to present results of varieties of grain which do poorly in Ontario as well as of those which give very satisfactory results. Occasionally merchants or growers who have seed for sale advertise extensively some varieties of crops which are not as a rule adapted to general cultivation in the country in which they are advertised. These remarks hold true with two kinds of wheat which have been quite extensively advertised in Ontario. One was advertised under the name of Corn Wheat, and which in reality was the wheat which is known quite extensively by different countries as the Polish wheat. The other variety was advertised recently under the name of Alaska wheat and was sold at extravagant prices. The Alaska wheat is very similar in characteristics to the Seven Headed wheat or the Miracle wheat which have also been advertised in their turn. We are, therefore, presenting results of both the Polish and the Seven Headed varieties of wheat in comparison with those of the Red Fife and the Wild Goose. Of the seven types or species of wheat there is a clear separation of the grain and the chaff of four of these types when the grain is threshed. In the other three, however, the chaff adheres to the grain even after it has been threshed with a separator. The table here presented gives the yield per acre in each of sixteen years of a leading variety of wheat, in each of the four species in which the grain and the chaff are easily separated:

Year.	Red Fife. (Triticum vulgare)	Wild Goose (Triticum durum)	Polish. (Triticum polonicum.	Seven Headed. (Triticum turgidum)
	Bushels.	Bushels.	Bushels	Bushels.
1897	20.7	23.1	16.3	6.5
1898	34.2	48.3	27.1	24.7
1899	39.2	44.5	24.5	26.4
1900	46.3	48.4	34.5	39.4
1901	24.1	32.1	15.6	22.2
1902	31.9	33.5	29.1	25.0
1903	43.5	47.1	32.8	34.3
1904	22.2	47.1	20.1	33.2
1905	35.9	41.5	28.7	30.8
1906	33.9	36.0	19.5	28.2
1907	28.0	33.2	18.7	19.1
1908	36.3	25.6	23.8	24.5
1909	40.1	34.8	20.4	25.7
1910	44.0	49.2	30.6	37.5
1911	10.2	14.0	1.7	5.2
1912	29.1	32.5	20.2	28.9

It does not take long in looking over the foregoing tabulated results to become convinced that neither the Polish nor the Seven Headed varieties of wheat are suitable for general cultivation in Ontario when it is considered that the quality of each of these grains is probably inferior to that of the Red Fife or the Wild Goose varieties. It will be seen that although the results vary considerably from year to year the Wild Goose and the Red Fife surpass the Polish and the Seven Headed varieties in yield per acre in the years in which the yields are high, as well

as those in which the yields are low. It will be clearly seen that it is not always the grain which is advertised the most extensively and sold at the highest prices that will give the most satisfactory results in this Province. The Government of Ontario is doing much to protect the farmers by an extensive system of experiments conducted at the Ontario Agricultural College, and through the medium of the Experimental Union. If farmers pay high prices for extravagantly advertised grains without studying the records of these grains they have themselves to blame. Although we had numerous enquiries in regard to each of these varieties of wheat when they were being advertised we believe that but few farmers were so foolish as to buy seed in large quantities, and at extravagant prices.

Varieties of Rye.

Thirty years ago there were about seven acres of spring wheat to every one acre of rye grown in Ontario. At the present time, however, the acreage devoted to the growing of these two classes of farm crops is not widely different, as in 1912 there were 123,080 acres of spring wheat, and 105,949 acres of rye. The rye crop was grown most extensively in 1912 in the counties of Northumberland, Norfolk, Durham, Ontario, Hastings, and Simcoe in the order here named, and the average of yield per acre over the whole Province was 17.4 bushels per acre in 1912, and 15.8 bushels per acre in 1911.

Varieties of Spring Rye. Three varieties of spring rye have been grown under similar conditions at the College in each of the past eight years. The spring rye usually makes a somewhat shorter growth and gives a lighter yield of grain per acre than the winter varieties. It is a rapid grower, however, and is usually free from smut and from rust. The following table gives the average results for eight years for each of the three varieties of spring rye:

Average Results for Eight Years.

Varieties.	Weight per Measured Bushel.	Straw per Acre.	Grain per Acre.
	lbs.	tons.	bush.
Petkos	55.0	2.00	28.7
Prolific Spring	54.8	1.89	25.7
Common	54.9	1.88	25.6

The Petkos variety of spring rye which heads the list in average yield per acre of the three varieties grown for eight years is a German variety. A small sample of this rye was obtained by the writer on his visit to Germany in 1901. It was obtained from the greatest rye breeder in Germany. At first it did poorly in Ontario being surpassed by each of the other varieties under experiment in each of the first three years in which it was grown at the College. From 1905, however, it has given high results in every year, and it has surpassed each variety in each season with one slight exception.

From the Petkos rye selections have been made at our College and we now have a new strain known as the O. A. C. No. 61, which has made a very excellent record. The new selection has surpassed the Petkos rye in yield per acre and was

distributed throughout Ontario in the spring of 1911 for co-operative experiments. In the records of the experiments at the College the O. A. C. No. 61 has surpassed the Petkos by an average of fully two and one-half bushels per acre per annum in the average of the past five years, and has also made the highest record in the co-operative experiments over Ontario.

Varieties of Winter Rye. In each of the past nine years, four varieties of winter rye have been under experiment at the College. The following average results of yield of grain per acre and in weight of grain per measured bushel have been obtained: Mammoth White, 59.5 bushels, 57.6 lbs.; Washington, 56.1 bushels, 57.7 lbs.; Common, 53.5 bushels, 56.9 lbs.; and Thousand Fold, 53.4 bushels, 57.4 lbs. In 1912, the Mammoth White variety gave a yield of 59.4 bushels per acre. It will therefore be seen that the Mammoth White variety of winter rye is exceedingly hardy, producing its average yield in 1912 in which season the winter wheats gave less than one-half their average yield of grain per acre. During the past nine years, the Mammoth White variety gave the greatest yield per acre of the different varieties of rye under experiment in each of seven years, and gave the second highest yield per acre in each of the other years. The four varieties of rye ripened at the same time in 1912 and also in the average of the nine years' experiment. In strength of straw, the Mammoth White proved to be the strongest and the Common the weakest variety in the average results, although all varieties stood up splendidly in 1912, the average height of the Mammoth White variety being about 6 feet.

Varieties of Buckwheat.

It may be a surprise to many farmers of Ontario to know that during the last ten years no other crop has increased in area to as great a percentage as buckwheat. The number of acres of Buckwheat in Ontario in 1902 was 93,324, and that for 1912 was 205,893, or an increase of over one hundred per cent. in the ten years. The only other crop which approaches the buckwheat in increase in acreage is Fodder Corn, but this was less than one hundred per cent. This increase in the acreage of buckwheat is probably due to several causes, such as, its value as a smothering crop for the eradication of weeds, the lateness at which the crop can be sown in the season and the comparative good yields of grain which can frequently be obtained from land which is only of fair quality. The following table gives the average results of eight years' tests with each of five varieties of buckwheat:

Average Results for Eight Years.

Varieties.	Weight per Measured Bushel.	Straw per Per Acre.	Grain per Acre.
	lbs.	tons.	bush.
Rye Buckwheat	51.9	1.96	35.8
Common Grey	39.8	2.67	25.3
Silver Hull	50.6	2.62	24.2
Japanese	38.4	2.69	24.1
New Calcutta	48.7	2.82	22.8

The Common Grey buckwheat of Ontario has been surpassed by the Rye buckwheat by an average of fully ten bushels per acre per annum. Not only is it true that the Rye buckwheat has surpassed the Common Grey variety in the average results, but the detailed records show that in every season of the eight year period the Rye buckwheat took the lead in productiveness. The Rye buckwheat is grown considerably in certain parts of the Maritime Provinces. The flour of the Rye buckwheat as compared with that of the Common Grey, the Silver Hull, or the Japanese varieties has a decidedly yellowish tinge.

Varieties of Field Peas.

Field Peas have filled in an exceedingly important place in Ontario's Agriculture. It seems a pity that the crop has not been grown quite as successfully in recent years as it was formerly. The pea crop occupies an important place in the rotation, it is comparatively easy on the land and leaves the soil in good condition for the following crops. The grain is very rich in flesh forming constituents, and both the grain and the straw add considerably to the fertilizing elements in the manure. In 1912 only 221,524 acres of peas were grown in Ontario in comparison with an average annual acreage of 596,786 acres for the past thirty-one years. Those Counties devoting the greatest area to pea growing in 1912 were, Bruce, Grey, Simcoe, Durham, Huron, Renfrew, and Wellington in the order here given. The decrease in the acreage of field peas in Ontario is due, to a considerable extent, to the ravages of the pea weevil (*Bruchus pisi*), and the unfavorable weather conditions for the pea growth during the past three years. There is considerable difference in the comparative results of the various varieties of peas which we have had under experiment and to which we wish to call the reader's attention. The following table gives the average results of thirteen years' experiments with each of eight varieties of peas which have been under test:

Average Results of Varieties of Peas.

Varieties.	Days to mature, average 16 years.	Length of vines, average 11 years.	Average results for 13 years.		
			Weight per measured bushel.	Straw per acre.	Grain per acre.
		ins.	lbs.	tons.	bus.
Early Britain	104	39	56.98	1,35	37.05
Potter	105	44	59.27	1.40	34.40
New Canadian beauty	106	45	60.36	1.36	29.67
Black-eyed marrowfat	107	41	59.63	1.38	29.64
White-eyed marrowfat	106	41	60.82	1.42	28.39
Golden vine	107	42	59.93	1.47	27.56
Prussian blue	109	44	60.00	1.57	27.53
Multipliers	111	48	60.25	1.72	25.66

It will be seen that the Early Britain surpassed the Multipliers by an average yield of over eleven bushels per acre per annum for the thirteen year period. The Multipliers, the Prussian Blues, and the Golden Vines have been grown extensively throughout Ontario, and these occupy lowest place in comparative yields of grain per acre. The Early Britain pea which stands at the top of the list was imported from England by the College fully twenty years ago. It is a brown pea of good size, and is well suited for feeding on the farm or for sale for the manufacture of split peas. Mr. H. Murton who has a Split Pea Factory in Guelph

has informed the writer that the Early Britain pea is an admirable pea for his purpose, and he is desirous that this variety be more extensively grown for the manufacture of split peas. The Early Britain has a vine of medium length and it is earlier in maturing than the Prussian Blue variety.

As the eleven varieties of peas have been under test for five years in succession at the College the results are interesting as including some new kinds not mentioned in the former list. The following table gives the average results of each of these varieties for a period of five years:

AVERAGE RESULTS OF VARIETIES OF PEAS.

Varieties.	Average results for 5 years.		
	Weight per measured bushel.	Yield of straw per acre.	Yield of grain per acre.
	lbs.	tons.	bus.
Early Britain	55.87	1.34	**35.15**
No. 20467 (Wash.)	57.44	1.52	**34.22**
Potter	58.59	1.32	**33.11**
Clamart	56.61	1.20	**32.19**
No. 12887 (Wash)	59.07	1.62	**31.71**
Black-eyed marrowfat	59.54	1.39	**29.56**
New Canadian beauty	60.09	1.26	**25.39**
Golden vine	59.80	1.57	**24.44**
White marrowfat	61.12	1.27	**22.60**
Prussian blue	59.81	1.50	**21.99**
Multipliers	59.85	1.60	**20.09**

It will be seen that the Early Britain occupies highest place not only of the eight varieties for the thirteen year period but also of the eleven varieties for the five year period. The variety which stands second in yield of grain per acre was obtained through the kindness of the Department of Agriculture at Washington, D.C. The Potter variety which occupies second place in the yield per acre in the results for thirteen years, and third place in the table for five years, is a large white pea of excellent quality. To those farmers of Ontario who are interested in the growing of peas we submit the results of these varieties for their careful consideration.

VARIETIES OF FIELD BEANS.

Although the acreage devoted to field beans in Ontario is somewhat limited and is confined largely to the Counties of Kent and Elgin, still the attention given to this crop seems to be increasing considerably. The total number of acres of beans in Ontario has increased from 45,029 in 1909 to 69,703 in 1912. Each of seven varieties of beans have been grown under experiment at the College for at least thirteen years. The following table gives the average yield per acre for thirteen years of each of the seven varieties of beans grown for that length of time:

AVERAGE RESULTS OF VARIETIES OF BEANS.

Varieties.	Average results for 13 years.	
	Weight per measured bushel.	Yield of grain per acre.
	lbs.	bus.
Pearce's Improved Tree	64.72	24.24
Scholfield Pea	65.08	22.72
White Wonder	64.90	21.68
Medium or Navy	64.93	21.59
Marrowfat	64.49	20.66
Small White Field	64.38	18.76
Large White Haricots	59.13	17.43

The Pearce's Improved Tree bean has made an excellent record. It stands at the head of the list of the seven varieties grown for thirteen years, and also of ten varieties grown for five years. The beans of the Pearce's improved Tree variety are white in color, medium in size, and of excellent quality. It will be seen that the Pearce's Improved Tree bean has given an average yield of about five and one-half bushels per acre per annum more than the Small White Field bean of Ontario.

In 1912 the season was very peculiar and unfavorable for the production of beans of high quality owing to the excessive wet weather. But few beans were matured and harvested in good condition this autumn.

VARIETIES OF SOY BEANS.

A number of enquiries have been received recently regarding the adaptability of Soy beans for Ontario. A considerable amount of interest has been taken in this crop in England, in the United States and in Canada. The crop furnishes exceedingly rich feed for farm stock, and the plants may be cut and converted into silage and they may be allowed to ripen for the production of grain. Although there are a large number of varieties the most of them require a long season to reach maturity and are unsuited for cultivation in Ontario. Upwards of thirty varieties have been under experiment at the College, but comparatively few of these have ripened their seed and the most of them have been dropped from the test.

In 1912 fourteen different varieties and selections of Soy beans were grown in the Experimental plots. These varied considerably in productiveness. The lowest yield of grain produced by any one variety was 359 pounds, and the highest was 956 pounds which was obtained from one of our own selections of the Early Yellow variety. This selection has proven to be one of the best sorts of Soy beans which we have had under experiment.

The Early Yellow Soy bean has now been grown at the College in each of seventeen years and the average yield per acre per annum for that period has been 14.3 bushels, taking 60 pounds per bushel as the standard for Soy beans. The Early Yellow Soy beans and the selections made from it at our College have been in the past and are at present the most promising kinds which we have found for growing in Ontario.

Vetches for Seed Production.

Although the Common Spring vetch has been sown in the Experimental plots at the College in each of a number of years it is only occasionally that it produces a crop of seed. In 1912 no seed, whatever, was produced at the College from the Common Spring vetch. It is a crop which is very unreliable when grown alone as a seed producer in Ontario.

Hairy Vetches have been considerably advertised as a farm crop in recent years. They have been highly recommended for use as a cover crop for orchards, and also for fodder production. As the seed is nearly all imported it is usually quite expensive, frequently costing from five to six dollars per bushel. Efforts have been made to ascertain whether the seed of this crop could not be grown successfully in Ontario. In experiments covering a period of eleven years in which Hairy Vetches were sown in the autumn for the production of seed in the following year, an average of 8.4 bushels of seed per acre has been obtained. In three of these years the yield has been upwards of 18 bushels, and in three other years less than 2 bushels per acre. In 1912 the yield per acre was 12.8 bushels. The Hairy Vetches which have been grown at the College for several years have produced about fifty per cent. greater yields of seed per acre than the Hairy Vetches which have been more recently imported.

The Hairy Vetches have been grown in recent years on some of the farms in the southern part of Ontario, and the seed production has been fairly satisfactory. In some years good yields of seed have been obtained. Some farmers are sowing a mixture of rye and vetches in the autumn. The rye tends to keep the vetches from the ground, and increase the production of a good quality of seed.

The Hairy Vetches are occasionally sown in the spring of the year for seed production, but the results are not nearly as satisfactory as those obtained from the autumn sowing. The vetches which are sown in the autumn usually give a yield of seed about double of that obtained from those which are sown in the spring.

Grass Peas.

The Grass pea is an annual legume which has been grown to a limited extent in Ontario for several years. The stems of the plants are flat and the whole crop is greatly relished by animals when used as a green fodder. It produces a large amount of grain which is angular in form and very hard. One marked advantage of the grain of the Grass pea is that it is entirely proof against the ravages of the pea weevil (*Bruchus pisi*). In the most favorable season the Grass pea gives a good yield of grain per acre, but in cool wet summers there is usually an abundance of growth but a very small yield of seed. The seed production of the Grass peas in 1912 was an utter failure. The average yield of grain per acre for the last eight years has been only about eleven bushels. Although the Grass peas were formerly grown considerably on farms in the southern part of Ontario they are now cultivated to a much less extent.

Cow Peas.

Cow peas are grown extensively in the Southern States, and many enquiries have been received regarding their value as a farm crop in Ontario. Many varieties have been under experiment at the College, but as yet no variety of Cow peas has given results which are sufficiently good to enable us to recommend it for

cultivation in Ontario. In 1912 three varieties were under experiment. None of these produced seed; in fact it is very exceptional that any variety of Cow peas will produce seed in this Province. Nearly all of the varieties require a much longer season for development than we possess in Ontario.

Varieties of Flax Grown for Seed.

According to the report of the Bureau of Industries there were 12,128 acres of flax grown in Ontario in 1911. More than one-half of this acreage was confined to the Counties of Lambton, Huron, Bruce, Grey, and Wellington. In each of seven years, experiments were conducted at the College in the growing of flax from seed which was originally obtained from Ontario, Manitoba, Russia, and Holland. The average results for the seven years showed an average yield of seed per acre per annum as follows: Manitoba, 17.6 bushels; Ontario, 16.4 bushels; Russia, 15 bushels; and Holland, 13.9 bushels. In 1912 the two last named varieties were dropped from the list and the Manitoba flax gave an average of 30, and the Ontario flax, 28.1 bushels per acre. The highest yield in 1912 was obtained from Minnesota No. 25 which gave a yield of 32.9 bushels of seed per acre.

Varieties of Millet for Seed Production.

Millet growing in Ontario, although not extensive occupies an important place in the agriculture of the Province. In some seasons the crop is grown much more extensively than in others. As it will stand late seeding it is often used for sowing on land which has been too wet to be sown with other crops at the right season. Millet is grown in Ontario for the production of green fodder, or of hay and for the production of seed.

In 1912 twenty-two varieties and selections of Millet were grown in the College plots. Of this number seven varieties have been grown in each of the past nine years. The following table is the average yield per acre of the seed, and the weight per measured bushel of the nine years' experiment with each of seven varieties of millet:

Varieties of Millet.

Varieties.	Average results for 9 years.	
	Weight per measured bushel.	Grain per acre.
	lbs.	bus.
Siberian	53.9	49.5
Steel Trust	54.7	45.6
Hungarian	53.7	42.7
Holy Terror Gold Mine	50.8	38.3
Golden Wonder	51.9	34.0
German or Golden	53.6	34.0
Common	54.2	32.8

The Siberian variety has uniformly produced high yields of seed per acre. The foregoing results show that this variety has given an average yield of almost 50 bushels of seed per acre per annum, while that produced by either the German or the Common varieties is less than 35 bushels per acre per annum.

In 1912 the yield of seed was much lower than usual, the highest records being as follows: Siberian and Golden Wonder each 30.6 bushels; Kursk, 27.4 bushels; and Hungarian Grass, 26 bushels.

Some of the selections of the Siberian Millet have been making fine records in seed production during the last few years.

Sunflowers as Seed Producers.

Although sunflowers have been grown in Ontario to a very limited extent in gardens and near the buildings, but little attempts have been made to grow the crop under field conditions, and but very few people have any accurate knowledge as to the comparative production of sunflowers with other crops. The seed of sunflowers has been recommended as useful as a feed for poultry, and it has been used for this purpose to a limited extent. In order to secure more definite information in regard to the amount of seed produced of the different kinds of sunflowers under Ontario conditions seven varieties were secured and were tested at the College for five years, after which all were discarded with the exception of three which have now been under experiment in each of the past fifteen years. The following table gives the average results of the size of the heads for twelve years, the average height of the heads, the yield of both heads and of whole crop per acre for fifteen years, and the average yield of grain per acre for fourteen years:

Varieties of Sunflowers.

Varieties,	Diameter, 25 heads, 12 Years.	Average Height, 15 Years.	Average Yield per Acre.		
			Heads, 15 Years.	Whole Crop, 15 Years.	Grain, 14 Years.
	Inches.	Inches.	Tons.	Tons.	Bushels.
1, Mammoth Russian	7.33	102	6.01	18.48	**79.18**
2. White Beauty	7.50	90	5.69	17.13	**75.11**
3. Black Giant	7.30	107	6.53	22.90	**73.90**

The standard weight per measured bushel of sunflowers is twenty pounds. It will, therefore, be seen that the Mammoth Russian variety has given an average of about 1,580 pounds of seed per acre per annum. This is equivalent in weight to about forty-six bushels of oats, or twenty-six bushels of wheat. The sunflowers are very hardy and usually produce good returns when many of the other crops are almost failures. In each of the years 1911 and 1912, the returns from the sunflowers were very satisfactory.

Varieties of Sorghum for Seed.

We have had under experiment upwards of thirty varieties of Sorghum at the College. These include different varieties of broom corn, sugar cane, Kaffir corn, millo maize, Jerusalem corn, etc. Not only is there a marked difference in the different classes of Sorghums but there are also great differences in the varieties of each of the classes, especially in the first two here named. We have had ten

years' experience in growing some of the varieties of sorghum for seed production. It is interesting to know that the greatest average yields per acre have been obtained from three varieties of broom corn, viz., Early Japanese, Early Evergreen, and Early California. Each of these has produced a yield of about twenty bushels per acre. The broom corns, however, when grown in general cultivation are cultivated with the object of securing the heads of the plants for the manufacture of brooms and whisks, rather than for the production of either fodder or seed. The sugar canes, such as the Early Amber variety, are grown in increasing quantities in some sections of Ontario for the production of pasture, green and dry fodder, and seed. The sorghums seem particularly suited to warm, rich, sandy loam. The sorghums are sown and cultivated in a somewhat similar manner to that of corn but the rows are usually placed rather closer together.

Varieties of Corn for Grain Production.

Owing to the cold, wet weather in the month of May, and the excessive rainfall in August, and the numerous rains in September, the varieties of corn did not ripen in 1912 as usual. As a fairly complete report of corn for grain production was presented in my annual report of last year, it is considered wise not to report the results of experiments of corn for grain production for the past season, as the weather conditions were so unusual that the results would be unsuitable as a guide for the average season.

Varieties of Potatoes.

A large number of most interesting experiments were conducted with potatoes in 1912. There was, however, an unusual amount of rot in the potato crop this year, and there has not been sufficient time for us to prepare the report in such a way as to bring out the most important lessons from the season's work. One of the most interesting features of the experiment with potatoes this year has been the fact that the varieties show great differences in their susceptibility to rot. Some of the varieties were almost free from rot while others were practically ruined by the disease.

Those varieties of potatoes which showed the smallest percentage of rotten tubers at the time of harvest were as follows: Extra Early Eureka 3, Stray Beauty and Irish Cobbler 5, Early Ohio 6, Pan-American 7, and Early Fortune and Irish Cups 9; and those varieties which showed the highest percentage of rotten potatoes were as follows: Carman No. 1, 84; Canadian Standard 62; Norcross 61; Uncle Sam 58; Eldorado 54; Crown Jewel 48; Vermont Gold Coin 48; and Rural New Yorker No. 2, 48. Of the late potatoes which were freest of rot the Davies' Warrior, the Delaware, and the American Wonder, were amongst the best.

Root Growing in Ontario.

It is perfectly true that corn growing in Ontario is increasing from year to year, and it is just as true that the cultivation of the root crops in Ontario still occupies an important place. In some parts of the Province the cultivation of roots appears to be rather more suited to the conditions and the requirements than the cultivation of corn. The root crops of Ontario amount in value to nearly $10,000,000 annually. They include Mangels, Sugar Beets, Swede and Fall Turn-

ips, and Field Carrots. The crops are nearly all consumed in Ontario with the exception of limited quantities of Swede Turnips and Sugar Beets which are exported to the United States.

As statistics in regard to the amount of land used for different crops have been carefully collected in Ontario for the past thirty-one years, through the medium of the Bureau of Industries, we are enabled to secure some interesting information in regard to the increases and the decreases in acreages of our various farm crops. A study of such statistics frequently enables us to understand certain phases of farming operations in a manner which cannot be obtained in any other way. In looking over the data in regard to the number of acres used annually for the different classes of roots interesting information can be obtained which cannot be given in detail in this brief report. I wish, however, to present a summary which will convey in a very concise manner some results which are worthy of consideration. The table here presented shows the average annual acreage of Turnips and Carrots taken separately and of Mangels and Sugar Beets taken together in each of three ten year periods.

Ten Year Period.	Turnips.	Field Carrots.	Mangels and Sugar Beets.
1883—1892.....	100,023	10,422	20,170
1893—1902.....	147,790	11,031	45,436
1903—1912.....	120,335	4,654	81,836

These figures show us that there has been a considerable decrease in acreage of turnips and of field carrots during the past ten years as compared with the ten years previous. It also shows that during the past thirty years the growth of mangels and sugar beets in Ontario has increased rapidly. It will be seen that while the turnips and the carrots are decreasing the mangels and the sugar beets are gradually increasing in this Province. It is probably safe to say that in a very few years the acreage devoted to the growing of mangels and sugar beets will be considerably greater than that used for the growing of swede turnips, fall turnips and field carrots.

Varieties of Mangels.

Mangels are classified into long, intermediate, tankard, and globe according to their shape, and each class is represented by a number of varieties. Some of these varieties vary greatly, not only in shape, but also in size and color. We have tested at the Ontario Agricultural College mangels under fully 117 different names. In some cases, however, the mangels under different names resemble one another so closely that they may be considered as the same variety, and yet there are frequently differences in purity of seed, in germination, and in productiveness even of these mangels owing to the varying conditions under which the seed has been grown, harvested, stored, etc. I remember testing long red mangels obtained from two different seedsmen, and known under two distinct names. I was afterwards told by one of the seedsmen that these two mangels were identical, and yet we found some difference in purity, in germination, in uniformity, and in productiveness. It is, therefore, very

difficult indeed to get anything like a definite knowledge of the different varieties of mangels from the seedmen's catalogues. It is also exceedingly important to conduct experimental work in order that the different varieties may be grown and studied under uniform conditions. As the seasons vary considerably it is unsafe to draw conclusions from experiments conducted for one or two years, but when the results are obtained for a sufficiently long period the results furnish information of great value. We have had ten different varieties of mangels under experiment at the College in each of the past eleven years, and five of them in each of the past nineteen years. A large amount of seed was used each year in order to get a uniform number of plants. Even with this great care, however, the stand of the plants was uneven in 1898 and 1909, and the results for those two years have been discarded. The following table gives the average yield per acre per annum of each of ten varieties of mangels grown under uniform conditions in each of ten years, and of five varieties of mangels in each of seventeen years:

Varieties of Mangels.

Varieties.	Tons.		Bushels.	
	10 years.	17 years.	10 years.	17 years.
Yellow Leviathan (Ferry)	31.1	28.3	1,028	935
Sutton's Mammoth Long Red	30.5	27.6	1,006	911
Carter's Windsor Prize Taker Yellow Globe	29.6	.....	977	.....
Rennie's Perfection Mammoth Long Red	29.5	.....	974	.....
Steele-Briggs' Giant Yellow Intermediate	29.3	27.1	967	893
Garton's Improved Yellow Globe	29.2	.....	964	.....
Ideal (Kirsche)	28.5	.....	941	.....
Simmer's Mammoth Prize Long Red	27.9	27.3	920	900
Steele-Briggs' Giant Yellow Globe	26.8	.....	883	.....
Bruce's Mammoth Red Intermediate	25.8	23.5	850	774

Of the ten varieties of mangels presented in the table the seed of six was obtained from five Ontario seedsmen, the seed of three from three English seedsmen, and the seed of one from a seedsman in Germany. The name in every case indicates the color and the shape of the root, with the exception of the Yellow Leviathan which belongs to the Intermediate, and the Ideal to the Tankard class. The results show that the variety which has given the highest average yield per acre belongs to the Yellow Intermediate class, the second to the Long Red, and the third to the Yellow Globe. We have, therefore, three distinct types of roots represented by the three highest yielding varieties in the average results for ten years. It will be noticed that the three lowest yielding varieties in the ten-year experiment also belong to the same three classes of roots as the three highest yielding varieties. It will, therefore, be seen that in these results there are greater differences amongst varieties than amongst the classes themselves. The summary shows that the Yellow Leviathan surpassed the Bruce's Mammoth Red Intermediate in average annual yield of roots per acre by 5.37 tons or 177.2 bushels. The results here presented show that the seed of mangels is influenced considerably in accordance with the variety to which it belongs.

Yellow Leviathan Mangel.

The seed of the Yellow Leviathan Mangel was first obtained by the Ontario Agricultural College from D. M. Ferry, Windsor, Ontario, in the spring of 1893.

The name "Yellow Leviathan" was entered in the catalogues of some of the other Ontario seedsmen as follows: The Steele-Briggs Seed Co., of Toronto, in 1896; Jas. Hewer, Guelph, in 1908; The Wm. Rennie Co., Toronto, J. A. Simmers, Toronto, and J. A. Bruce, Hamilton, in 1909; and Geo. Keith, Toronto, in 1910.

In each of the past four years we have obtained seed, under the name of Yellow Leviathan, as advertised by a number of the Ontario seedsmen. These different lots have varied considerably in purity, in germinating power, in shape, and in color. The seed which produced roots each year resembling most closely those obtained from the first seed secured by the College was that obtained from the D. M. Ferry Co., Windsor, the Steele-Briggs Seed Co., Toronto, and the Wm. Rennie Co., Toronto.

In each of the past few years seed of the Yellow Leviathan variety of mangels has been produced at the Ontario Agricultural College. The following table gives the percentage of germination of the mangel clusters of the Yellow Leviathan variety of mangels as grown at the College, and as obtained from D. M. Ferry, the Steele-Briggs Co., and the Wm. Rennie Co. in each of three years:

Sources.	1909	1910	1911	Average 3 years.
Ontario Agricultural College	142	90	137	**123**
D. M. Ferry & Co.	84	101	129	**105**
Steel-Briggs Seed Co.	85	96	116	**99**
The Wm. Rennie Co.	41	85	61	**62**

The germination of the seed was obtained with much carefulness in the field. The average results in the foregoing table are those of eight distinct tests. It will be seen that the seed which gave the highest per cent. of germination was that grown at the Ontario Agricultural College in 1909 and in 1911, and that obtained from D. M. Ferry & Co., in 1910.

In 1911 there was a registered frost at the College, of two degrees on September 14th, and the mangel seed was not collected until September 26th. This frost apparently proved disastrous to the germination of the mangel seed as its vitality was practically ruined.

Germination of Mangel Seed.

In each of the past four years very careful determinations have been made in the field as to the percentage of plants produced from exact numbers of clusters planted under uniform conditions. This was an extensive experiment made in a definite way to determine the actual percentage value of different varieties of mangel seed obtained from different sources, and in different years. In order to show the great variation of these results we simply here enumerate the extreme percentage of germination of the clusters of mangels of the different varieties tested in each of four years.

Years.	Varieties.	Per cent.
1909	Ontario Seed Co's Ideal	174
	Rennie's Perfection Mammoth Long Red	15
1910	Steigler's Yellow Leutewitzer	158
	Steele-Briggs' Yellow Globe Selected	15
1911	Steele-Briggs' Prize Mammoth Long Red	219
	Rennie's Yellow Leviathan	60
1912	Rennie's Perfection Mammoth Long Red	125
	Bruce's Gate Post Mammoth Long Red	125
	Mette's Yellow Eckendorf	35

It will be seen that there is a very great variation in the germination of the clusters of mangels of the different varieties in each of the past four years. It is not a matter of variety, however, as the seed of the Rennie's Perfection Long Red which was the lowest, with a germination of only 15 per cent. in 1909, occupied the highest place with a germination of 125 per cent. in 1912. It will also be seen that it is not a matter of seedsmen as the Wm. Rennie Co. sold mangel seed which occupied the lowest place in germination in 1909 and again in 1911, and the highest place in 1912, and the Steele-Briggs Seed Co. sold mangel seed which occupied lowest place of all the varieties in 1910, and the highest place of all the varieties in 1911. The germination of the mangel seed has a much greater influence on the actual returns of a crop than many people realize. If we wish to grow mangels in Ontario with the hope of securing a good crop it is absolutely essential that we use seed of good vitality.

Varieties of Sugar Beets.

The growing of sugar beets in Ontario is of comparatively recent date. No statistics were collected by the Ontario Bureau of Industries regarding the sugar beet crop until the year 1907. The average acreage of sugar beets for the past six years has been 21,119 acres and the average for 1912 was 21,054. As there were 60,103 acres of mangels grown in Ontario in 1912 it will be seen that there are fully three acres of mangels to every one acre of sugar beets grown in this Province. Part of the sugar beets are grown for the production of sugar and part of the sugar beets, or as they are more properly termed sugar mangels, are grown for the production of feed for farm stock. Those varieties of sugar beets which have been bred extensively for sugar production usually give about fifteen per cent. of sugar when grown in this country, while those which are raised more particularly for stock feed will contain on an average only about eight or ten per cent of sugar.

Eighteen varieties of sugar beets were grown at the College in 1912. Some of these, however, have been under test a comparatively short time. The following table gives the average results in tons of roots per acre and also in percentage of sugar of the fourteen varieties which have been grown at the College in each of the past five years.

VARIETIES OF SUGAR BEETS OR SUGAR MANGELS.

Varieties.	Length.		Percentage sugar.	Yield per acre, 5 years.
	Above ground.	Below ground.		
	inches	inches		tons.
Bruce's Giant White Feeding	3.85	5.46	8.1	25.94
Tankard Cream	3.69	4.98	8.6	24.73
Rennie's Jumbo	3.98	4.82	.....	24.68
Steele-Briggs' Giant White	3.95	5.12	.....	23.73
Rennie's Giant Half Sugar White	3.90	4.87	.....	23.25
Bruce's Giant Rose Feeding	3.45	5.61	13.0	21.26
Rennie's Giant Sugar	3.46	5.40	10.3	21.20
Simmers' Imperial Giant Half Sugar	3.38	5.49	10.6	20.95
Darch and Hunter's Colossal White	2.83	5.30	.....	20.73
Royal Giant (Steele-Briggs)	3.36	5.18	10.2	20.06
Rennie's Danish Improved	3.32	5.36	11.1	19.96
Rennie's Leviathan	3.40	4.68	.....	19.73
Simmers' Improved Imperial	1.78	5.83	16.8	16.34
Simmers' White Silesian	.81	6.28	13.7	15.32

The percentage of sugar was determined by the Chemical Department at the College. It will be seen that the Bruce's Giant White Feeding heads the list with an average of almost twenty six tons per acre. Of all the varieties grown in 1912 the greatest yields per acre were produced by the Bruce's Giant White Feeding, Steele-Briggs' Giant White and Tankard Cream.

Each of six varieties of sugar beets has been grown at the College in each of the past thirteen years, and the following are the average yields in tons of roots per acre per annum for the thirteen year period: Giant White Feeding 26.4; Royal Giant 22.8; Giant Rose Feeding 22.6; New Danish Improved 22.2; White Silesian 19.1; Improved Imperial 17.1.

VARIETIES OF SWEDE TURNIP.

Twenty-two varieties of Swede Turnips were grown in 1912. Those giving the highest yields per acre were as follows: Carter's Best of All, 27.1 tons; Garton's Model, 25.3 tons; and Garton's Monarch, 25.0 tons. Not one of these varieties, however, gave the highest yield per acre in 1911. It is therefore important to take the average results for a number of years as the best guide. The results of experiments of Swede Turnips in 1907 and in 1908 were exceedingly poor, and no records of these years are worthy of publication. Each of eight varieties, however, has been successfully grown under experiment in each of the years 1906, 1909, 1910, 1911 and 1912. The following table gives the average yield per acre for the five-year period in the case of each of the eight varieties:

VARIETIES OF SWEDE TURNIPS.

Varieties.	Weight per root.	Yield of tops per acre.	Yield of roots per acre.
	(lbs.)	(tons)	(tons)
Keepwell (Garton's)	1.85	7.81	20.71
Carter's Prize Winner	1.74	7.62	19.39
Carter's Invicta	1.71	8.24	18.95
Good Luck	1.73	7.76	18.80
Sutton's Magnum Bonum	1.68	8.31	18.38
Simmer's Defiance	1.57	7.18	17.50
Improved Hall's Westbury	1.55	7.33	17.01
Hartley's Bronze Top	1.52	7.69	16.65

It will be seen that the Hartley's Bronze Top, a variety of turnips which at one time gave excellent results in Ontario, now occupies the lowest place in the average yield of roots per acre when the results for five years are considered. This variety has been surpassed by fully four tons per acre per annum by the Keepwell, which was followed closely by the Carter's Prize Winner. The Keepwell, which is an English variety of turnips, is a comparatively new kind which appeared in the average results of last year for the first time.

We have had each of three varieties of Swede Turnips under experiment in each of ten years and the average yields in tons of roots per acre per annum have been as follows: Hall's Westbury, 20.0; Sutton's Magnum Bonum, 19.3; Hartley's Bronze Top, 18.2.

Varieties of Fall Turnips.

Although the Fall Turnips gave heavy yields per acre, they are grown in Ontario to only a limited extent. We have no statistical results for the Province to show us the comparative acreage devoted to the fall turnips in comparison with the Swedish varieties. The fall turnips are sometimes designated as soft turnips, and sometimes as white turnips. They are much softer than the Swede turnips, and do not keep well into the winter. Eleven varieties of the fall turnips were grown at the College in 1912 and the greatest yielders per acre were the Sutton's Purple Top Mammoth, 23.1 tons; Red Top White Globe, 22.2 tons; and Sutton's Imperial Green Globe, 21.1 tons.

Two varieties of fall turnips have been grown under experiment in each of eleven years and the average yield per acre for the whole period has been in tons of roots per acre per annum—27.1 in the case of the Red Top White Globe, and 20.3 of the Cow-Horn variety.

Varieties of Field Carrots.

Field carrots are not grown nearly as extensively in Ontario at the present time as they were a few years ago, but there is still an area of nearly 3,000 acres devoted to this crop annually. The introduction of the sugar beets for feeding purposes and the great increase of the area in the growing of mangels has undoubtedly had considerable influence in reducing the acreage of carrots. The following table gives average results of growing each of five varieties of carrots in each of the past thirteen years:

Varieties of Field Carrots.

Varieties.	Color.	Length of roots.	Yield per acre.
		inches.	tons
Mammoth Intermediate Smooth White	White	8.4	28.6
Steele's Improved Short White	"	8.6	28.5
Simmer's Improved Giant Short White....	"	8.4	27.4
Large White Belgian	"	11.3	25.0
Carter's Gate Post Orange Long.....	Yellow	9.1	22.6

It will be seen that under proper treatment very large yields per acre of field carrots are obtainable. Each of two varieties has given an average of over twenty-eight tons of roots per acre for the thirteen-year period. Twenty-eight tons are

equivalent to 924 bushels. It is interesting to note that each of the short white varieties included in this experiment has surpassed considerably in yield of roots per acre the Large White Belgian variety. It is also important to remember that the Large White Belgian carrots grow long and slender and are very difficult to harvest. The three varieties occupying the highest place in yield per acre are quite similar in their characteristics, the roots of each kind being white, comparatively short, and cone-shaped.

Varieties of Kohl Rabi.

The Kohl Rabi plants resemble cabbages in their root development, and Swede turnips in the appearance of their leaves. The valuable part grows about three inches above ground in the form of a bulb. Kohl Rabi as a class of roots is not grown extensively in Ontario. The crop is sometimes used for domestic purposes in about the same way as the Swede turnips. When grown as a feed for stock, the crop is harvested and stored somewhat similar to mangels and turnips, although occasionally it is pastured in the autumn.

Although several varieties have been under experiment, the most of them have been discarded and the three leading kinds have been continued in the test. The average yields in tons per acre per annum for the eleven-year period are as follows: Earliest Erfurt, 17.2; Early White Vienna, 17.1; and Goliath Purple, 15.4. It will be seen that the yield per acre of the Kohl Rabi does not equal the average yield of the mangels or the carrots.

Varieties of Parsnips.

Parsnips have been used in Ontario for domestic purposes but not to any noticeable extent as a feed for farm stock. Inquiries have been received, however, as to the comparative value of parsnips with other kinds of roots for feeding purposes. In order to glean some information regarding the amount of the relative yields of the parsnips in comparison with the other roots, experiments of a few varieties were undertaken at the College. All the varieties have now been discarded from the list with the exception of two, which have been continued in each of thirteen years, during which time the New Ideal Hollow Crown and the Sutton's cattle variety have each given an average of 11.2 tons per acre per annum. The comparative yields per acre of these roots place them to a disadvantage in appearance with mangels, sugar beets, turnips, and carrots.

Varieties of Corn for the Silo.

Statistics in regard to corn for the silo have been collected in Ontario through the medium of the Bureau of Industries in each of the past twenty-one years. According to this source of information, the number of acres devoted to fodder corn in this Province in 1892 was 91,403; in 1902, was 209,859; and in 1912, was 377,982. It will, therefore, be seen that there is a very substantial increase in the amount of land devoted to the growing of fodder corn in Ontario. The number of acres used for this crop in 1912 was greater than in any year previous. In fact, the only three seasons in which there has been upwards of 300,000 acres of fodder corn in Ontario have been the last three. This change may have been brought about to a certain extent through weather conditions, as there has been about nineteen thousand acres decrease in the area devoted to the growing of corn for husking during the same three-year period. The average yield per acre of the fodder corn

in Ontario in each of the past five years has been as follows: 1908, 11.7 tons; 1909, 11.7 tons; 1910, 11.6 tons; 1911, 11.2 tons; and 1912, 10.5. It will be seen that the yield per acre in 1912 was slightly lower than that of any of the four years previous. In 1911 the weather was exceptionally hot and dry in Ontario, and yet the yield of corn was almost up to the standard, while in 1912, which was cool and wet, the yield was somewhat below the average, which has been 11.4 tons per acre for the past twenty-one years. Those counties in Ontario in which fodder corn was grown most extensively in 1912 are as follows: Oxford, 25,643 acres; Middlesex, 23,272 acres; Lambton, 15,893 acres; Carleton, 15,889 acres; Perth, 14,348 acres; and York, 14,339 acres. Although Essex leads the Province in the production of corn for harvesting, only 3,808 acres in corn for the silo were grown in 1912.

It scarcely seems necessary to state that no one variety of fodder corn is equally valuable for all parts of the Province. Not only is this true, but it is also a fact that in many cases no one variety is the best for a single neighbourhood, owing to differences in the quality of soil, conditions of the underdrainage, etc. While this is true it is at the same time very important that each farmer should ascertain as nearly as possible which particular variety of corn is likely to give the best results upon the soil of his own farm. Even on a single farm one variety of corn may give the best results in one place and another variety in another place. In order to find out the best varieties for different localities and for different farms it is necessary to conduct some local experimental work in conjunction with some investigations which are carried on at Provincial Institutions. It is well for each person to make a careful study of experiments which have been conducted in the Province as a basis for his own work. In this search for information he could obtain great assistance from results of experiments which have been conducted at our College at Guelph with a large number of varieties, for not only the total yield per acre, but also the yield of ears, stage of maturity, etc., are all taken into consideration. The variety experiments conducted at the College serve as a general guide to the farmers in most parts of Ontario, indicating to them the kinds which are likely to be suitable to their respective requirements. The requirements of the different localities are so different that it seems necessary to give results which can be studied by individual farmers in order that the greatest value from the experiments may be obtained. We are, therefore, presenting the average of five years' experiments of each of forty-nine varieties of corn which have been grown under uniform conditions. It must be remembered that a large number of varieties which have given only medium results have been already discarded from the list. The experiment each year was conducted in duplicate, so that we have the average of ten distinct tests made within the five-year period. For these experiments the corn was usually planted during the last ten days in May, and it was harvested about the middle of September. Immediately after the crop was cut the weight of the whole crop was taken, after which the ears were husked, counted, weighed and examined. The stage of the maturity of the corn has been indicated by the condition of the corn at the time it was harvested. The seven terms which were used to describe the corn in regard to its ripeness were as follows: Water, Early Milk, Milk, Late Milk, Dough, Firm Dough, and Ripe.

The following list is the average of the five years' experiments with each of forty-nine varieties of corn, and the list is arranged according to the total yield of green crop per acre, including the stalks, the leaves, and the ears.

VARIETIES OF CORN.

Varieties.	Description of Varieties.		Average Results of Five Years' Experiments—1908–12.					
	Class of Corn and Color of Grain.	Average number of rows per ear. 5 years.	Condition of Grain when harvested.	Number of days until in full tassel.	Height of Plants.	Weight per ear.	Yield per Acre.	
							Husked Ears.	Total Crop Green.
					Inches.	Ounces.	Tons.	Tons.
1. Eureka	Yellow Dent	16	Early Milk	102	122	7.02	2.51	**23.58**
2. Landreth's Large White Flint	White Flint	12	Early Milk	102	114	5.33	2.30	**21.41**
3. Salzer's North Dakota	White Flint	8	Dough	88	99	6.34	3.44	**19.46**
4. Reid's Yellow Dent	Yellow Dent	18	Early Milk	96	114	6.80	2.93	**19.19**
5. Indian White Flour	Flour	8	Dough	85	98	7.44	3.58	**18.96**
6. Stowell's Evergreen	Sweet	14–16	Milk	95	96	6.27	2.99	**18.73**
7. Mammoth Southern Sweet	White Dent	14–16	Early Milk	100	112	5.22	2.00	**18.69**
8. Mogul	White Dent	18	Early Milk	100	110	5.85	2.53	**18.65**
9. Gold Nugget	Yellow Flint	8	Firm Dough	84	100	8.81	4.18	**18.53**
10. Longfellow	Yellow Flint	8	Firm Dough	85	96	5.80	3.02	**17.78**
11. Improved Leaming (Vick)	Yellow Dent	18	Milk	91	110	8.66	3.74	**17.77**
12. Marblehead Mammoth	Sweet	14	Milk	93	91	7.36	3.16	**17.48**
13. Hoopengardner's Very Early Yellow Dent	Yellow Dent	16	Milk	87	107	9.45	4.23	**17.34**
14. Primitive	Yellow Flint	12–14	Late Milk	98	98	5.80	2.95	**17.34**
15. Wisconsin No. 7	White Dent	14–16	Milk	87	102	8.67	3.92	**17.13**
16. Smith's White Cap Yellow Dent (Duke)	Yellow Dent	16	Late Milk	87	106	9.52	3.97	**17.10**
17. Early Butler	Yellow Dent	14–16	Milk	89	110	7.68	3.49	**16.87**
18. Compton's Early (Clark)	Yellow Flint	12	Firm Dough	83	99	7.62	3.62	**16.72**
19. Compton's Early (Duke)	Yellow Flint	12	Firm Dough	84	98	7.91	3.84	**16.40**
20. White Cap Yellow Dent (E. M. Zavitz)	Yellow Dent	14	Dough	83	104	8.74	3.95	**16.02**
21. Simmer's Mammoth Eight-rowed	Yellow Flint	8	Firm Dough	82	89	5.75	3.12	**15.94**
22. Bailey (Duke)	Yellow Dent	16	Late Milk	88	104	7.98	3.67	**15.92**
23. King Phillip (Duke)	Colored Flint	8	Firm Dough	81	94	6.73	3.32	**15.78**
24. Genesee Valley	Yellow Flint	8	Firm Dough	81	90	5.83	3.10	**15.77**
25. Rennie's x x x Early Sweet	Sweet	12	Milk	85	82	7.57	3.99	**15.61**
26. White Cap Yellow Dent (Thomas)	Yellow Dent	12–14	Late Milk	83	100	7.93	3.54	**15.18**
27. Longfellow (Duke)	Yellow Flint	8	Firm Dough	80	91	6.08	3.08	**15.12**
28. Australian Extra Early Eight Rowed White	White Flint	10–12	Firm Dough	81	92	7.21	3.73	**15.04**
29. Canada Yellow	Yellow Flint	8	Firm Dough	81	88	6.12	3.06	**15.01**
30. Leaming (Duke)	Yellow Dent	16	Late Milk	89	107	8.45	3.47	**15.00**
31. Red Blazed	Colored Flint	8	Firm Dough	80	94	7.17	3.34	**14.78**

32. Golden Glow or Wisconsin No. 12	Yellow Dent	16	Dough	82	99	8.45	3.99	**14.73**
33. White Cap Yellow Dent (Dawson)	Yellow Dent	14	Late Milk	86	104	8.33	3.45	**14.62**
34. Country Gentleman	Sweet	.....	Milk	92	87	5.55	2.82	**14.51**
35. Early California Flint	Yellow Flint	12	Ripe	81	89	7.13	3.77	**14.40**
36. Wisconsin No. 8	Yellow Dent	16	Dough	82	96	8.10	3.71	**13.89**
37. Sterling White Dent	White Dent	14	Dough	83	96	8.01	3.34	**13.63**
38. University No. 13	Yellow Dent	16	Firm Dough	79	96	7.72	3.73	**13.47**
39. White Cap Yellow Dent (Hammond)	Yellow Dent	14	Dough	80	95	7.70	3.53	**13.27**
40. Howling Mob	Sweet	12–14	Late Milk	80	77	8.21	4.27	**13.14**
41. Pearce's Early Evergreen	Sweet	12–14	Late Milk	78	80	7.94	4.22	**12.65**
42. Early Strawberry (Martene)	Colored Dent	12	Ripe	79	80	7.59	3.53	**12.50**
43. Seymour's Sweet Orange	Sweet	12	Late Milk	83	76	5.08	3.06	**12.31**
44. Simmer's Earliest Ripe	White Dent	12	Firm Dough	78	78	6.63	3.11	**12.07**
45. Golden Justice	Sweet	8	Dough	78	66	6.13	3.18	**11.73**
46. Mammoth White Cory	Sweet	8–10	Dough	74	65	5.79	3.33	**10.61**
47. Wisconsin Little Dent	Yellow Dent	14	Firm Dough	75	86	7.31	3.46	**10.05**
48. Malakhoff	Sweet	8–12	Dough	70	53	2.63	2.36	**7.92**
49. Golden Bantam	Sweet	8	Dough	74	59	3.86	2.54	**7.76**

There is probably no table of varieties given in this report which is worthy of more careful study than the one here presented, giving the average results of the different varieties of corn. Every farmer has a very good knowledge of the habits and the results of one or more varieties of corn for his own farm or for his own locality. By comparing the results of the other varieties on the list with the one variety of corn with which he is most familiar he is in a position to get a good idea as to whether any of these varieties would be likely to give better results than the variety which has been grown in his neighborhood. Some people have had the inclination to grow the variety of corn which gives the greatest total yield per acre. This is often a mistake. When growing corn for the silo, although total yield is valuable, it is also very important to grow a variety which will produce a good yield of grain or of ears and will reach a good stage of maturity in the locality where it is grown before there is much danger of frost. While it is important to have bulk, it is also very important to have quality and to have about the right percentage of water in the crop, so that when it is placed in the silo it will heat properly and not become sour by containing too much water or become moulded or fire-fanged by containing too small a percentage of water. While the Eureka variety of corn is reported as producing the highest total yield per acre, it will be observed that the grain was only in the Early Milk condition and that there were only two and one-half tons of ears per acre. The Eureka variety is, therefore, a very large, late-growing corn, which is only suitable on a few of the warm, early soils in southern Ontario, where the crop naturally grows rather small and reaches maturity at a comparatively early date. The Wisconsin No. 7 gives fully six tons per acre less than the Eureka variety, but it is somewhat earlier and produces 3.9 tons of ears per acre. In the tabulated results here presented the White Cap Yellow Dent variety is reported five times. These five strains were obtained from five different farmers who have been growing them on their own farms for a number of years past. Naturally, each man would select according to his own desire and through selection in this way we find there is a great difference in the various strains of the White Cap Yellow Dent. It will be observed that in total crop per acre the five different strains occupying relative positions on the list are as follows: 16th, 20th, 26th, 33rd, and 39th. The Smith's White Cap Yellow Dent gave 17.1 tons to total crop per acre, while that obtained from Hammond gave only 13.3 tons per acre. At the same time it will be observed that the Smith's strain was in the Late Milk condition and the Hammond's strain had reached the Dough condition. The White Cap Yellow Dent obtained from E. M. Zavitz, of Middlesex, although only about one ton per acre less in the total yield than the Smith strain, reached a considerable earlier stage of maturity and as large a yield of ears per acre. It will, therefore, be seen that for growing corn for the silo or for fodder it is important not only to secure the best varieties but also to secure the best strains of the best varieties.

In the spring of each year the Experimental Union distributes throughout Ontario seed for three experiments with corn, one with fodder corn, one with varieties of corn for husking, and one with sweet corn for table use. Usually three different varieties are distributed for each of these experiments, which enables the farmers to ascertain for themselves which of the most promising varieties in the experiments would produce the most satisfactory results on the individual farms.

Varieties of Sorghum for Fodder.

The term Sorghum is a somewhat comprehensive one, and includes a number of different classes of crops, such as the sugar canes, the broom corns, the Kaffir corns, etc. Instead of using the term sugar cane for these crops they are sometimes spoken of as saccharine sorghums to distinguish them from the true sugar canes of the south. The sorghums are nearly all used more or less for fodder production, and some of them are used for other purposes such as the sugar cane for the production of syrup, the broom corn for the production of material for the manufacture of brooms and whisks, Jerusalem corn for the production of grain, and all of them are used for the production of seed.

The sorghums thrive well in a comparatively hot, dry season when the grain crops make a much smaller growth. In the Experimental plots at Guelph none of the varieties have been used for silage, and only one variety, the Early Amber Sugar Cane, has been used for pasture. For the production of fodder, eleven varieties were under experiment in 1912. Of this number six varieties have been grown under similar conditions in the Experimental Department in each of fourteen years. The seed was planted each year about the same way as corn except that it was planted somewhat closer together. Three plants were allowed to remain in each hole and the holes were about twenty-seven inches apart each way. In 1912 a change was made in the method of planting by the seeds being placed in rows twenty-six inches apart and ten inches apart in the rows. One plant was allowed in each place. In each year the sorghum received cultivation throughout as required. The experiment was conducted in duplicate in the past season. The following table gives the results of each of six varieties for 1912, and the average results for the past fourteen years:

Varieties of Sorghum.

Varieties.	Height.		Yield of heads per acre.		Total yield per acre.	
	1912	Average 14 years, 1899–1912.	1912	Average 14 years, 1899–1912.	1912	Average 14 years 1899–1912.
	ins.	ins.	tons.	tons.	tons.	tons.
Orange Sugar Cane	73	89	.39	.34	11.90	**17.81**
Early Minnesota Sugar Cane	112	106	.64	.75	19.05	**17.18**
Early Amber Sugar Cane	105	95	.63	.92	15.00	**15.55**
California Golden Broom Corn	105	109	.94	1.39	9.30	**11.13**
Early Japanese Broom Corn	110	106	1.24	1.37	11.95	**9.89**
Improved Evergreen Broom Corn	114	107	1.23	1.31	12.50	**9.61**

Although the Orange Sugar Cane occupies highest place in average yield of crop per acre, it is a comparatively late variety and not so suitable for growing in Ontario, as some of the other kinds. The Early Minnesota Sugar Cane is a strong, vigorous grower and is comparatively early. The Early Amber Sugar Cane has been grown more extensively in Ontario than any other variety. There is a great difference in the seed obtained from different sources. As a rule the seed obtained from the Central or Western States is much later in maturing, and is more likely to produce an unsatisfactory crop than the Ontario grown seed. In 1912 the Early

Amber Sugar Cane grown from Ontario Seed surpassed that grown from seed which came from the United States, not only in earliness, but also in yield per acre of 1.5 tons. The three varieties of broom corn, although occuping lower places in yield per acre than the sugar cane, are earlier in maturing and produce much larger yields of heads per acre. The broom corns are non-saccharine, while the sugar canes contain a considerable amount of sugar, and the latter are greatly relished by cattle when fed in the dry condition in the winter, especially after the animals become accustomed to eating the crop. The Yellow Milo Maize and the Jerusalem corn, which have been grown in each of thirteen years previous to 1912, were dropped from the experiments this year, as the average yield per acre of the Yellow Milo Maize was only 8.8 and the Jerusalem corn only 5.6 tons per acre. The highest yields of green crop per acre in 1912 were obtained from the Early Minnesota sugar cane 19.1 tons; Asungu Seed Bulrush Corn 15.3 tons; Early Amber Sugar Cane 15.0 tons; Imperial Sugar Cane 13.8 tons; and Improved Evergreen Broom Corn 12.5 tons.

In each of the past two years an interesting experiment has been conducted in our Experimental grounds to ascertain the comparative value of seed obtained from different plants of the Early Amber Sugar Cane. In 1911 it was found that there was a difference not only in germination, but also in height of plants, in character of growth, in earliness, and in maturity. In 1912 the experiment was repeated with five of the same strains, which were used in 1911, and also the seed from twelve additional plants. The results for 1912 show that there was a variation in yield of crop per acre from 7.5 tons to 11.3 tons of green fodder, and from three-fifths of a ton to one and one-third tons of heads per acre. This experiment will likely be continued, not only to ascertain the comparative differences from the different heads, but also with the object of securing an early, uniform, productive variety of sugar cane. We hope in another year to extend this experiment considerably, as we believe that proper selections from the Early Amber Sugar Cane can be secured, which will form a decided addition to the farm crops of Ontario to use both for fodder and for pasture purposes.

Varieties of Millet for Fodder Production.

We are unable to glean information through the Ontario Bureau of Industries regarding the acreage used for millet in Ontario from year to year. It is grown with a good deal of irregularity. In some seasons when the spring opens early and the grains, potatoes, corn, and roots are sown and planted at the proper time and when there is a good showing for hay, the amount of land used for millet is comparatively small, but in other years when the spring is cool, wet, and consequently very backward, and especially when the previous year was hot and dry and the winter severe, and consequently the clover crop was reduced in area and in yield per acre, the millet crop proves to be an exceedingly important one, as it can be sown late in the season and will usually furnish a comparatively large crop of hay of fairly good quality. Hence, we observe that in some years millet seed sells at a comparatively low price, while in other years the price of the seed is greatly increased owing to the heavy demand.

Twenty-two varieties of millet were grown in Experimental plots at Guelph in 1912. Seven of these varieties have now been grown under test in each of eighteen years, and the average yield in tons of green crop per acre per annum for these varieties has been as follows: Japanese Panicle 10.1; Golden Wonder 10.0; Holy

Terror Gold Mine 9.9; Japanese Barnyard 9.1; German or Golden 8.5; Hungarian Grass 8.3; and Common 7.8.

The following table gives the results of each of nine varieties of millet for 1912 and the average results for five years:

VARIETIES OF MILLET.

Varieties.	Height.		Yield per acre.			
			Green Fodder.		Hay.	
	1912	Average 5 years 1908–12.	1912	Average 5 years, 1908–12.	1912	Average 5 years 1908–12.
	ins.	ins.	tons.	tons.	tons	tons
1. Japanese Panicle	33	38	7.30	9.37	3.40	**4.09**
2. Holy Terror Gold Mine	31	34	5.00	8.21	2.05	**3.43**
3. Hungarian Grass	32	34	4.90	7.47	2.00	**3.17**
4. Steele Trust	30	33	5.50	7.85	2.20	**3.17**
5. Golden Wonder	28	33	4.70	7.58	1.95	**3.14**
6. Siberian	29	32	5.75	7.50	2.25	**3.10**
7. Japanese Barnyard	43	37	7.25	7.39	2.95	**2.95**
8. German or Golden	32	34	4.75	7.10	2.00	**2.90**
9. Common	34	34	5.10	7.10	1.90	**2.82**

It will be seen that the Japanese Panicle variety not only gave the highest yield per acre of green fodder of the seven varieties grown for eighteen years, but it has also produced the highest yield of green fodder and of hay per acre in the average of five year's results with each of nine varieties. The Japanese Panicle variety of millet was brought from Japan by Professor Brooks of the Agricultural College at Amherst, Mass., in the United States. Prof. Brooks had occupied a position on the staff of an Agricultural College in Japan for seven years previous to his return to the United States. He brought with him three varieties of millets representing three types, viz., Japanese Panicle, Japanese Barnyard, and Japanese Common. The Japanese Panicle millet produces plants of an upright growth and a spreading head. There is a large development of leaf and the crop usually lodges much less than a number of other millets. A few years ago a number of the seedsmen illustrated in their catalogues the Japanese Panicle millet and described the Japanese Barnyard variety, and when a farmer would write for seed of the Japanese Panicle millet he would frequently receive seed of the Japanese Barnyard variety. Most of the seedsmen have revised their catalogues, but a few are still repeating the mistakes which they have made in regard to these millets for a number of years. The two millets are entirely different in appearance and have produced results which vary considerably, the Japansese Barnyard coming near the bottom and the Japanese Panicle at the very top of the list in yield of green crop and in yield of hay per acre in the average results for five years. In ordering the Japanese Panicle millet it is wise to first obtain a sample and be sure that the seeds are of a dark brown color and very shiny. The Japanese Panicle and the Japanese Barnyard millets not only represent different varieties but actually different species.

Sowing Millet at Different Dates.

In each of six years an experiment was conducted in sowing Hungarian Grass, Japanese Panicle, and Japanese Barnyard varieties of millet on May 15th, June 1st, June 15th, July 1st, July 15th, and August 1st. The results show that the highest yields in tons of green crop per acre were obtained from the seedings of the following dates: Japanese Panicle, June 1st, 9.3; Japanese Barnyard, June 1st, 7.7; and Hungarian Grass, June 1st, 7.9;

Varieties of Sunflowers for Fodder.

As there was a considerable amount of discussion in Ontario regarding the value of sunflowers, especially of the sunflower heads, for mixing with corn for the silo, it was thought advisable to experiment with a few varieties of sunflowers in order to get more definite information regarding the productiveness of the crop and a knowledge of the principal varieties obtainable. Seven different varieties were at first included in this experiment but after a few years' experiments they were all dropped but three kinds. Each of these three varieties have now been under experiment for fifteen years and the following are the average results in height of plants, yield of heads per acre, and yield of whole crop per acre: Black Giant, 107 inches, 6.5 tons, and 22.9 tons; Mammoth Russian, 102 inches, 6. tons, and 18.5 tons; and White Beauty, 90 inches, 5.7 tons, and 17.1 tons.

Varieties of Rape, Kale, Cow Cabbage, Etc.

The area devoted to the growing of rape in Ontario now amounts to about 40,000 acres annually. According to the report of the Bureau of Industries fully one-half of the rape grown in this Province is confined to the counties of Grey, Dufferin, and Wellington. The Dwarf Essex Rape has been grown more or less in the Province of Ontario for many years. The rape plant resembles the Swede turnip in its leaf and the cabbage in its root. It is the leaf and the stem which furnishes the valuable portion for feeding to live stock. Rape makes an excellent late summer and autumn crop for fattening cattle, sheep, and lambs, for which purpose it has been used at the College quite extensively in the past years. Over 600 lambs were pastured on rape on the College farm in one season a few years ago. The lambs did exceptionally well, remaining in good health and increasing rapidly in weight.

In our experiments at the College we have included a number of crops which can be handled in much the same way as rape for feeding in the autumn as green fodder or as pasture. These experiments have included rape, kale, cabbage, etc., and furnish some good information in the comparative results when grown in Ontario under uniform conditions. Some of these crops which are not well known in Ontario are grown more extensively in Great Britain.

Thirteen varieties of rape, kale, etc., were under test in the College plots in 1912. The crops were all sown in rows 3⅓ links (26⅔ inches) apart. Each plot was exactly 1-100 of an acre in size, consisting of three rows each four rods in length. The seed was sown at the rate of two pounds per acre, and the plants of each variety were thinned to two inches apart in the rows. In general practice, however, it would be wise to sow about one and one-half pounds of seed to the acre and omit the thinning. The land between the rows was cultivated occasionally

throughout the growing season. The seedings in 1909 and 1910 took place on June 21st, in 1911 on June 20th, and in 1912 on June 24th. In ordinary seasons it is preferable to sow about the 20th June. When the crops had reached their best condition for feeding each variety was cut with a scythe and weighed immediately.

In England the cow cabbage is usually transplanted and the plants are placed at a sufficient distance apart to enable them to form heads. In our experiments at Guelph, however, we have simply treated the cow cabbage in exactly the same way as we have treated the rape. The heads of the cabbage, therefore, have been quite small, the growth being principally leaf and stem. In another experiment in which the cow cabbages were thinned to one, two, three, eight, sixteen, and twenty-four inches apart, it was found in 1912 that the highest yield per acre was obtained from those plots in which the plants were left at a distance of three inches apart, the yield being 26.3 tons per acre on the average. The average yields per acre from thinning eight inches apart were 24.5; sixteen inches apart 22.5 tons; and twenty-four inches apart 17.4 tons.

The following table gives the results of each of ten varieties of rape, kale, cabbage etc., grown in 1912 and for the average of five years:

VARIETIES OF RAPE, KALE, CABBAGE, ETC.

Varieties.	Height.		Green Fodder per acre.	
	1912.	Average 5 years 1908–1912.	1912.	Average 5 years 1908–1912.
	ins	ins.	tons.	tons.
World Beater Cabbage (Darch & Hunter)	18	19	21.70	**26.52**
Simmer's Early German Brunswick Cabbage	15	16	23.98	**25.54**
Simmer's Matchless Flat Dutch Cabbage	17	18	20.70	**24.84**
Sutton's Earliest Drumhead Cabbage	19	19	23.09	**23.76**
Sutton's Giant Drumhead Cabbage	20	20	19.54	**23.61**
Sutton's Earliest Sheepfold Cabbage	16	18	19.76	**23.10**
Large Seeded Umbrella Rape	29	29	18.81	**21.23**
Thousand Headed Kale (Hunter & Co.)	30	33	17.87	**20.97**
Dwarf Essex Rape (Steele–Briggs)	23	26	15.87	**20.20**
Sutton's Purple Sprouting Boroccoli	26	29	18.09	**19.73**

It will be seen that the three highest yielding varieties are from seed obtained in Ontario, one from Darch and Hunter of London, and two from J. A. Simmers of Toronto. These are followed by three varieties from Sutton & Sons of Reading, England. The Dwarf Essex rape which is the most commonly grown variety of rape in Ontario occupies the second to the lowest position in the average yield of green crop per acre. The World Beater Cabbage surpassed the Dwarf Essex Rape by an average annual yield of over six tons per acre per annum. The appearance of the cabbage when growing in the field is very deceiving, as it does not grow nearly as tall as the rape and always makes a much higher record at the time of harvest than most people would imagine from examination of the plots.

Five varieties of rape, kale, and cabbage have been grown in the Experimental grounds in each of thirteen years. The following gives the average results of the duplicate plots grown in 1912, and also the averages for the thirteen-year period:

Varieties.	1912.	Average 13 years.
	tons.	tons.
Sutton's Earliest Drumhead Cabbage	23.09	24.40
Thousand-headed Kale	17.87	21.95
Sutton's Earliest Sheepfold Cabbage	19.76	21.21
Dwarf Essex Rape	15.87	20.53
Purple Sprouting Boroccoli	18.09	19.69

In the results here presented which extend over a long period of time, it will be seen that the cabbage has surpassed the rape in yield of green crop per acre. In 1912 the same variety gave the highest yield per acre which stands at the top of the list in the average results for the thirteen-year period.

Miscellaneous Leguminous Crops for Green Fodder.

Twenty varieties of vetches, Soy beans, cow peas, and grass peas, were grown under similar conditions in an experimental way in 1912. These were all leguminous crops, and were studied from the standpoint of the production of green fodder. The highest yields in tons of green crop per acre produced in 1912 were obtained from the following varieties: Early Yellow Soy Beans No. 111, 8.9; Early Yellow Soy Beans, No. 81, 8.1; the Medium Green Soy Beans, 8.1; the Habara Soy Beans, No. 20105, 7.8; Grass Peas, 7.6; Common Vetches, 7.2; and Early Yellow Soy Beans, 6.5.

Each of seven varieties of leguminous crops have been under experiment in each of five years and the added experience adds to the value of the results. We here present in tabulated form the average returns for this length of period:

Varieties.	Height.	Yield per acre.
	ins.	tons.
Grass Peas	30	8.2
Ito San Soja Beans	23	6.6
Early Yellow Soy Beans	24	5.6
Akasaya Soy Beans	26	5.3
Hairy Vetches	24	5.1
Brown Soy Beans	22	4.2
Wonderful Cow Peas	13	3.3

It will be seen that Grass Peas head the list in the five-year period, and that the only one variety of cow peas included in the test comes at the bottom of the list with only 3.3 tons of green crop per acre.

In each of the past twelve years four varieties of leguminous crops have been grown under similar conditions and the following average results for the whole period in height of crop in inches and in yields of green crop per acre in tons are as follows:

Varieties.	Height.	Yield per acre.
	ins.	tons.
Hairy Vetches	29	6.9
Grass Peas	34	6.9
Early Yellow Soy Beans	25	6.5
Wonderful Cow Peas	15	4.8

In these average results the hairy vetches and grass peas have given the same yield per acre, the average being 6.9 tons in each case. It will also be seen that the variety of cow peas is again at the bottom of the list with an average of slightly under 5. tons of green crop per acre. The hairy vetches which occupy the highest place in average yield per acre for the twelve year period are used, not only as a fodder crop, but as a cover crop for orchards in some sections of Ontario, and for this purpose they are spoken of very highly by those who have used them in this way.

Pasture Crops in Ontario.

There are in Ontario at the present time about 6,450,000 acres in grass and clover. Of this acreage slightly over 3,000,000 acres are used for pasture crops. There was a gradual increase in the pasture lands of the Province up to the year 1906, but since that date the acreage in pasture has been slightly decreasing, until it is now about the same as it was in 1903. It is to be hoped that the recent decrease in acreage in the pasture lands means better pastures and more intensive farming. If greater attention were paid to the pasture lands I believe that the same amount of pasture could be obtained as at present on a very much less acreage. In order to do this, however, it is necessary to give much more attention to pasture lands than has been given in the past. It is a question if the pasture land in Ontario is not one of the weakest parts of the agriculture of the Province. In discussing the question of pastures the subject may be taken up under three separate headings according to the length of time in which the pasture is to remain unbroken.

Annual Crop for Pasture.

If a farmer realizes in the autumn or in the early spring that his pasture crop is going to be deficient for his requirements during the coming summer, he may be anxious to know what mixutre to sow in the spring to furnish the best pasture the same season. After testing seventeen crops separately and six different combinations within the last seventeen years, we would recommend the following mixture:

Oats	51 lbs. per acre.
Early Amber Sugar Cane	30 lbs. per acre.
Common Red Clover	7 lbs. per acre.
Total	88 lbs. per acre.

The oats and the sugar cane are mixed together and are sown from the grain box of the seed drill, and the clover is sown from the grass seed box placed in front of the tubes of the drill. If this mixture is sown during the first week in May, it is usually ready for pasture about the 20th of June. The oats are early and rapid in growth; the sugar cane is later, stools well and thrives in hot weather; and the clover forms the principal pasture in the autumn. All varieties are readily eaten by the animals, especially the oats and the sugar cane. If desirable, the clover may be allowed to remain over winter to furnish one or two cuttings in the following year. The tramping by the cattle has not caused any marked degree of injury either to

the plants or to the soil. During each of the past seven years we have had from eight to ten acres of this pasture which we have used for steers in each of the first five years and for milk cows in the last two years. The pasture is able to carry more than one two-year-old steer or one cow per acre. The animals have thrived splendidly keeping in the best of health. The steers have gained on the average about two pounds per day and the cows have made an excellent record in milk production. The details of this experiment will be given more fully at another time.

Pasture Crop for Two or More Years.

Many farmers seed their grain with Timothy and Common Red Clover, and, after taking off one crop of hay, use the land for pasture until it is again plowed. The clover soon disappears, and the timothy forms a comparatively poor pasture, especially in dry seasons. The following mixture is better for pasture purposes:

Red Clover	6 lbs. per acre.
Alsike Clover	3 lbs. per acre.
Orchard Grass	3 lbs. per acre.
Meadow Fescue	3 lbs. per acre.
Timothy	3 lbs. per acre.
Total	18 lbs. per acre.

This mixture can be sown in the spring of the year either with or without a grain crop. It should be sown in front of the tube drill: the clover and the timothy from the grass seed box, and the orchard grass and meadow fescue by hand. It could be used as a hay crop in the following year and for pasture afterwards. In comparison with timothy, this mixture will start earlier in the spring, produce a greener growth in the hot, dry months of the summer, and furnish a more abundant growth of leaves in the autumn.

Crop for Permanent Pasture.

Land which is not required in the regular rotation of the farm, can often be seeded with a permanent pasture mixture to excellent advantage. From more than twenty years' work in testing different varieties of grasses and clovers, both singly and in combination, I would suggest the following mixture for a permanent pasture under average conditions of soil, drainage and climate:

Alfalfa or Lucerne	5 lbs. per acre.
Alsike Clover	2 lbs. per acre.
White or Dutch Clover	2 lbs. per acre.
Orchard Grass	4 lbs. per acre.
Meadow Fescue	4 lbs. per acre.
Tall Oat Grass	3 lbs. per acre.
Meadow Foxtail	2 lbs. per acre.
Timothy	2 lbs. per acre.
Total	24 lbs. per acre.

The seed of this permanent pasture can be sown in the early spring, either with or without a grain crop. It is better to follow some cultivated crop which has been carefully looked after during the previous season. If the seed is sown alone, the tops of the plants should be cut occasionally during the summer and allowed to lie on the ground as a mulch. If a nurse crop is used, about one bushel of barley or of wheat per acre is recommended. As a rule, oats do not form a good nurse crop for a permanent pasture mixture. The seed for the permanent pasture should be sown in front and not behind the tube drill. Some of the finer seeds can be sown from the grass seed box, and the others by hand.

Such a mixture as this when once well established on suitable land, should produce a good pasture, appetizing to the animals, excellent in quality, abundant in growth, and permanent in character.

Alfalfa Growing in Ontario.

In many places in Ontario alfalfa will produce from two to three crops of hay per acre per annum, and in some localities hay can be obtained from the first crop and seed from the second crop in the same season. The following table gives the yields per acre of the different cuttings for both green fodder and hay of alfalfa as produced at the College in each of fifteen years:

Years.	Green crop.					Hay.				
	First Cutting	Second Cutting	Third Cutting	Fourth Cutting	Total.	First Cutting	Second Cutting	Third Cutting	Fourth Cutting	Total.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1896	9.96	6.47	4.06	2.06	22.55	3.08	1.91	1.29	.65	6.93
1897	12.04	5.61	4.42	.....	22.08	3.59	1.56	1.23	.....	6.38
1898	9.71	5.85	2.64	.....	18.20	2.30	1.75	.63	.....	4.68
1900	11.93	6.00	1.60	.....	19.53	2.33	1.47	.80	.....	4.60
1901	9.70	2.20	7.49	.....	19.39	2.03	1.00	1.50	.....	4.53
1902	13.35	8.69	2.96	.....	25.00	2.50	2.02	.54	.....	5.06
1903	13.10	8.53	2.75	.....	24.38	2.50	2.09	.67	.....	5.25
1904	12.45	9.35	4.00	.....	25.80	3.40	2.50	1.08	.....	6.98
1906	9.78	6.60	4.85	.....	21.23	2.55	1.13	.58	.....	4.26
1907	14.55	3.95	.....	.....	18.50	2.95	1.05	.....	.....	4.00
1908	9.70	6.75	3.73	.....	20.18	2.50	1.15	.75	.....	4.40
1909	8.68	4.56	.84	.....	14.08	2.52	1.40	.14	.....	4.06
1910	15.08	3.88	4.76	.....	23.72	2.94	.80	1.32	.....	5.06
1911	8.00	1.80	1.36	.....	11.16	1.76	.34	.30	.....	2.40
1912	9.48	4.68	4.72	.....	18.88	2.03	.99	.56	.....	3.63
Average 15 years	11.17	5.66	3.35	.14	20.31	2.60	1.41	.76	.04	4.81

The results furnished in the accompanying table are those of experiments which took place in different parts of the Experimental grounds, mostly in comparative tests with different varieties of clover. In each year the seed was sown in the spring at the rate of 18 to 20 pounds per acre, and usually with a grain crop such as barley sown at the rate of one bushel per acre. The results here presented are from different seedings, and are mostly from returns obtained from three to six or seven years after the seeding took place. In each of thirteen years the alfalfa gave three cuttings, but in 1907 it produced only two, while in 1896 it gave four cuttings in the one season. The spring of 1896 opened up very early and

1907 was very late. The highest average yield of hay per acre was produced in 1904, in which year nearly seven tons per acre were obtained from the three cuttings. In comparison with this high yield we observe that the lowest production was in 1911 when only 2.4 tons per acre were obtained. In the average results for fifteen years the alfalfa has produced an annual yield of upwards of twenty tons of green crop and of nearly five tons of hay per acre.

Alfalfa can be satisfactorily grown on many farms in Ontario. Its large yield of nutritious feed for farm stock, its perennial character of growth, and its beneficial influence on the soil are all features which commend it very highly for those farms on which it can be grown successfully. From experiments conducted at the Ontario Agricultural College during the past sixteen years we would offer the following suggestions for its cultivation.

Select land having a clean, mellow, fertile, surface soil overlying a deeply drained, sweet subsoil. Use large, plump seed of a hardy variety and which is free from impurities and is strong in germinating power. Inoculate the seed with the proper kind of bacteria, providing alfalfa has not been grown successfully on the land in recent years. Sow the alfalfa seed at the rate of about twenty pounds per acre. The seeding can take place according to any one of the following methods:

1. Alfalfa seed may be sown on winter wheat in the early spring either on the old snow or on a fresh snow of one or two inches and no harrowing or cultivation is necessary.

2. On a suitable seed bed and as soon as the land is sufficiently dry in the spring, alfalfa seed may be sown from the grass seed box placed in front of the tube drill. About one bushel of barley, wheat or rye per acre sown from the tubes of the drill makes a very good nurse crop. After the seed is sown the land should be harrowed lightly.

3. Alfalfa may be sown alone in the month of July on a summer fallow, provided there is sufficient moisture for good germination.

Alfalfa should never be pastured during the first year and seldom, if ever, afterwards as pasturing very frequently destroys the plants. The crop should be cut for hay or for green fodder in the following year after the seeding takes place as soon as it starts to bloom. Care should be taken to retain as many of the leaves on the stems as possible and to protect the crop from rain. In many places in Ontario the alfalfa will produce three crops of hay per acre per annum. The third cutting, however, may be used to advantage for mixing with corn when filling the silo, as this forms an easy method of handling the green alfalfa in the autumn, and also of improving the quality of the corn silage.

If the directions here given are carefully followed the alfalfa may be expected to produce large and valuable crops for a number of years without re-seeding.

Ontario Variegated Alfalfa.

Some very interesting information has been obtained in connection with the Alfalfa investigations during the past few years, and this information is likely to be worth a great deal in connection with the permanent establishment of alfalfa growing in Ontario. It is undoubtedly true that alfalfa growing in this Province has been in a critical condition in the past few years owing to the large importations of alfalfa seed from the Southwestern States of a strain of alfalfa which has been grown under mild climatic conditions for so long that it has become very tender. It has been ascertained, however, that there are some hardy strains of

alfalfa which appear to be quite suitable for growing in this Province and which have withstood some of the severest winters of recent years.

The whole number of species of alfalfa is quite limited, and for our present consideration only two need to be mentioned, viz., the Common Alfalfa (*Medicago sativa*), and the Yellow Flowered Alfalfa (*Medicago falcata*). The Common alfalfa has been grown extensively in many of the countries of the world in which the climate is not too severe. It possesses plants of an upright growth, flowers which are violet in color, and seed pods which are in the form of coils or spirals. The Yellow Flowered alfalfa grows wild in a number of the countries of Europe and Asia. Its use as a cultivated crop has been very limited. The plants have a spreading habit of growth and are usually considered to be very hardy. The flowers are yellow in color and the pods are in the form of a crescent or a sickle.

The plants of alfalfa are naturally cross-fertilized; hence, if plants of the Yellow Flowered alfalfa are grown in the midst of or in the near proximity to the Common variety, there is a natural crossing or mixing of the two kinds of alfalfa. The apparent ease with which natural cross-fertilization takes place, explains the reason for the existence of the different kinds of alfalfa plants which vary more or less in their characteristics, particularly in their color of flowers and in their evident hardiness. Some of these hybrids which have received distinct names have been grouped into a general class which is known as Variegated alfalfa. A good many of the alfalfas of Europe and of Asia show more or less variegated flowers. In America we have at present three different varieties of variegated alfalfa the seed of which is grown in a commercial way, viz., the Sand lucerne of commerce, the Grimm alfalfa of Minnesota, and the Ontario Variegated alfalfa, each of which has made high records in experiments conducted in Canada and in the United States. It is probably safe to say that the Grimm alfalfa of Minnesota and the Ontario Variegated alfalfa are the two hardiest and most important varieties of alfalfa which are grown as a regular farm crop.

The Ontario Variegated alfalfa is grown by some of the farmers in parts of the counties of Lincoln, Welland, and Haldimand, and to a very limited extent in some of the other countries. In many sections of the Province, however, the Common and more tender variety from the Western States has been introduced in recent years. The Common alfalfa of the Southwestern and the Central Western States traces its history largely to South America, from which country it was brought to California about fifty years ago and has extended eastward to Utah, Nebraska, Kansas, and some of the other states.

In the summer of 1912 this department was instrumental in having alfalfa fields, on about 150 farms of South-western Ontario, examined in such a way so as to enable us to know the extent to which the Variegated alfalfa is at present grown in this Province. Numerous fields of Variegated alfalfa were found in the counties of Welland and Lincoln, and an occasional field was found in Haldimand and in Lambton counties. It seems evident that at one time there was some variegated alfalfa in Haldimand and in Lambton counties, but this has been so much mixed with the Common alfalfa that the percentage of variegated flowers which now appear in most of the fields is comparatively small.

We regret very much that owing to the excessively wet weather in August and the numerous rains in September the production of alfalfa seed in Ontario has been a failure this year. In most years the yield of alfalfa seed in the Niagara District is very satisfactory, and it is probably safe to say that the failure in seed production was perhaps the greatest in 1912 that it has been within the past twenty years.

The central portion of the Niagara District is considered to be one of the very best sections for the production of alfalfa seed east of the Mississippi River. With proper care the production of the Variegated alfalfa seed in this Province should become a very important industry not only for the farmers who produce the seed, but also for those farmers who are anxious to get good, pure seed of alfalfa of a hardy strain, which will withstand even the severest winters of this Province.

We hope in the near future to present more detailed results of the very interesting and valuable information which we are gleaning on the subject of alfalfa growing in Ontario.

It is the earnest hope of the writer of this report that the results here submitted may prove of real value in the advancement of crop production in Ontario, and in contributing to the knowledge of the farmers who are already doing so much in the progress and in the welfare of this Province.

Respectfully submitted,

C. A. ZAVITZ.

PART XV.

THE LECTURER IN ECONOMICS.

To the President of the Ontario Agricultural College:

SIR,—I have the honor to submit my report for 1912.

ECONOMICS.

The class-room work has been about the same as usual.

During the winter term I gave a course of lectures to Second Year on the Principles of Political Economy, to the Third Year a course on Rural Economics, and to the Fourth Year a course on Co-operation and Organization of the Agricultural Industry.

During the Fall term the course given to Second Year was Agricultural Economics, to the Third Year a similar course but of a slightly advanced nature; and to Fourth Year a short course—one lecture per week—on the Principles of Modern Industry.

PUBLIC SPEAKING.

During the winter term I again acted as instructor to the Second Year in this subject. The class was divided in two divisions, and each of these divisions was again divided in groups of eight. In this way opportunity was given to eight students to deliver a speech or to take part in a debate at each session. Thus, every student got four turns at platform work.

My aim in this department has been to offer helpful criticism to the pupil on manner, diction, choice and treatment of theme, rather than to attempt to teach elocution, a subject which is not at all within my powers, and is even of doubtful value to the average agricultural student.

ENGLISH COMPOSITION.

My work in this subject is again with the Second Year. During the Fall term five essays were read, critically examined, and handed back, with suggestive notes, to each student. In all five hundred essays were dealt with in this way, in addition to the regular lectures on the principles of correct writing.

Through all of the eight courses, given or directed by me, it is my pleasure to report the keenest interest on the part of the students, the most perfect harmony between instructor and pupils, and sufficient progress to make the work thoroughly enjoyable.

Respectfully submitted,

H. H. LEDREW.

PART XVI.

THE DIRECTOR OF HOME ECONOMICS.

To the President of the Ontario Agricultural College:

SIR,—I have the honor to submit herewith the ninth annual report of the work of the Home Economics Department for the year 1912.

THE WORK IN GENERAL.

There have been several changes made in the work during the past year. We have successfully opened the Associate Course in Home Economics—a two-year non-professional course corresponding somewhat to the Associate Course in Agriculture, and we look forward to the day when it will be even more popular than the Homemaker Course. The increased number of Homemaker students is due to the opening of new classes in January and April as well as in September. The number might easily have been doubled, and it is evident that there is a good demand for the longer courses.

The Education Department recently decided to demand but one year's special training for its Public School Household Science teachers, and to require at least Second Class professional teacher standing for admission to it. This makes graduates of our Two-year Normal Course ineligible for employment in Ontario Public Schools unless they possess a Second Class professional teacher certificate. To prevent misunderstanding, our two-year course will be known in future as the Normal Course in Domestic Science, while the one-year course will be the Normal Course in Household Science: but no difference has been made in the work of either class.

The Education Department was desirous that we give a three months' course in Household Science last spring to Grade A graduates of the Normal Schools in accordance with the new regulations. We could not do so because our regular classes tax our staff and class-rooms to their full extent until the end of June.

It will be noticed that the number in attendance is smaller than last year. This is partly because of the increase in Long Course students, and the consequent decrease in Short Course students, and partly because no Summer Course was given last year.

The work has run smoothly as usual, and is apparently appreciated through the country.

THE NORMAL COURSE IN DOMESTIC SCIENCE.—TWO-YEAR.

The entrance age of this class was raised to twenty years last September, and this, together with the new Education Department regulations, was expected to greatly reduce the number of applications. But, again, far more than could be accepted sought entrance, and we have been able to choose a very promising class from them. According to the Education Department regulations, only those graduates of this course who hold Ontario First or Second Class professional teacher certificates will be eligible for Household Science teacher positions in the Ontario Public schools. There are, however, many other fields opening to them in commercial, hospital dietitian and Women's Institute work, which yield equally satisfactory returns.

The Guelph public schools furnish four classes for our practice-teaching. One class has to be taken in the Consolidated School, owing to lack of kitchen room here, but no disadvantage results, since the student-teacher faces actual school conditions.

Fifteen entered this course in 1910; fourteen passed on to the senior class in 1911; eleven passed the final examinations and have received the Macdonald Institute Teachers' Certificate in Domestic Science. Fourteen were admitted to the junior class in September, 1911; twelve passed on to the senior class last September and are now in attendance.

The Normal Course in Household Science.—One-Year.

Nine were admitted to this class in September 1911; all passed the final examinations in June, 1912, and have received the Macdonald Institute Teachers' Certificate in Domestic Science. This year's class was limited to ten, and it was difficult to choose them from fifty applicants, but the result is the usual strong class.

This is the class we formerly admitted to the senior year of the Two-year Course, conditioned upon their making up certain junior year work. The name is the only thing changed, the work is the same as last year's.

The Associate Course.

When Macdonald Institute opened in 1903 a two-year non-professional course was offered, but there proved to be no demand for so long a course, and the shorter Homemaker Course took its place. Recently we have felt a real demand for a two-year course especially planned for the girl desirous of preparing for life in the country, and we are trying to meet it with the Associate Course. The junior year work will resemble the junior housekeeper's, but the senior year will apply the class-room and laboratory study to problems of the home rather than the institution, and will cultivate a broader outlook than is possible to the Homemaker. Graduates of this course will be called Associates in Home Economics, corresponding to the College Associates in Agriculture. At present the entrance requirement is Matriculation standing, or two years of high school work plus one year of work at home. As in the other non-professional courses, preference is given to farmers' daughters until sixty days before the class opens. The course was first advertised last June, and opened last September with nine students. We already feel its opening justified and prophesy great development along this line.

The Housekeeper Course.

Thirteen entered the course in September, 1910; eight passed on to the senior class in September, 1911, and a member of an earlier class returned to complete her course; eight passed the final examinations of June, 1911, and have received the Macdonald Institute Housekeeper certificate. Thirteen entered the course in September, 1911; twelve passed into the senior class and are now in attendance. Six entered the junior class last September. We accepted the full number of twelve for the junior class, but for various reasons the majority dropped off just before opening day. The capable women we want for this class easily find employment and we had difficulty in raising the number to six. We regret this very much, because trained housekeepers are already in demand, and two years hence they will be

wanted in many quarters. There are many capable women in Ontario working for small wages, who could by this course prepare themselves for good positions with salaries equal to that of the average domestic science teacher.

Following are some of the positions to which our Housekeeper graduates have been appointed in 1912:

Name.	Class of	Appointed to
Miss E. R. Black	1912	University of Saskatchewan, Saskatoon, Sask.
" E. C. Bonnell	1910	Asylum for Insane, London, Ont.
" A. Boughner	1912	General Hospital, Brockville, Ont.
" C. Doering	1912	Byrn Athyn School, Pa., U.S.A.
" W. Frank	1911	University of Saskatchewan, Saskatoon, Sask.
" S. Hadwen	1910	Oregon Agricultural College, Corvallis, Ore., U.S.A.
" L. McLellan	1911	Riverdale Hospital, Toronto, Ont.
" A. Pringle	1912	Sick Children's Hospital, Toronto, Ont.
" L. L. Wright	1912	Hospital of Jacksonville, Ill., U.S.A.

The Homemaker Courses.

In former years we have opened but one Homemaker class and begun it in September; during the last year we have opened a new class each term, and the system is working satisfactorily. The class is growing increasingly popular with farmers' daughters, and its numbers will double the moment there is residence room for them.

Twenty-four were accepted for the course opening September, 1911; fifteen passed the final examinations last June and have received the Macdonald Institute Homemaker diploma. Sixteen entered the course last January, of whom 9 passed the final examinations in December, 1912, and have also received the Homemaker diploma. Eight entered the course last April, and five are still in attendance. Twenty-six began the course last September.

The Short Course in Domestic Science.

The Short Course in Domestic Science had in attendance in the

Winter term, from January to March	**36**
Spring term, from April to June	**19**
Autumn term, from September to December	**26**

The Short Course in Sewing.

The Short Course in Sewing had in attendance in the

Winter term, from January to March	**7**
Spring term, from April to June	**7**

This course has been dropped owing to the pressure of numbers in the other courses, and the fact that its ground is pretty well covered by the Homemaker and the Short Courses in Domestic Science.

Other Courses.

We had six optional students last year who joined various sewing and lecture classes.

Three student-workers have availed themselves of the opportunity to pay for courses by service in Macdonald Hall.

1912 Graduates and Summary of Attendance.

The list of graduates from Home Economics Courses is printed elsewhere.

The summary of attendance for this department is printed elsewhere. It will be noted that the total number is smaller. This is due to the increasing number of long course students, which of course lessens the number of short course students; to the fact that we did not carry the Summer Course for the Education Department, nor the evening classes, which proved unsatisfactory last year; and to the fact that many of the public school pupils in the 1911-1912 classes continue in the 1912-1913 classes. The number of students in attendance at any one time has been practically the same for three years.

Women's Institute Work.

The work of helping Women's Institute members to prepare papers or speeches for the meetings by lending them material from our library and clipping collection is growing steadily. We have had requests for information on:

Home Interests	63
House and Housekeeping	87
Food and Cookery	168
Dietetics	19
Health	33
Household Finance	10
Home Economics Education	45
Clubs, Social Service, etc.	192
Gardening	11
Miscellaneous	57
Total	685

and these requests were answered with

2,396 folders with pamphlets, magazine articles or clippings;
90 books;
141 special letters;
39 letters regretting that material wanted was already out on loan;
32 letters regarding subjects not dealt with by our collection.

Needs of the Home Economics Department.

The expansion of the work of this department has been hampered for the past three or four years. The causes have been brought to your attention periodically, but we repeat them again in the hope that the coming year will bring us the prospect of increased usefulness to the women of this country.

1. Lack of Residence Room: The parents of this country want to give their young daughters home economics training, and are willing to send them away from home to get it, but they are not willing to send them where they must live alone in ordinary boarding-houses. They are right in this matter, and if the College is to do its share in training these girls, further provision must be made for them. In 1912 we refused 168 eligible students because we had not room for them; 52 more grew tired of waiting for openings and dropped off the waiting lists; and we refused 65 for the new classes opened in January.

2. The need of more Institute Rooms: This is largely dependent upon increased residence room, but certain improvements in the Homemaker Course have been held up for want of the room used for boys' classes.

3. The need of increased clerical assistance: The library work has hitherto been done by the department stenographer, while the Women's Institute assistance work has been managed with the aid of temporary clerical assistance. Students and teachers have discovered the usefulness of the Loan Collection; the Women's Institute work has increased greatly; and the general correspondence has doubled owing to the waiting list business. It is no longer possible to cover the work, and we must either drop the Women's Institute work or relieve the office force. A Librarian—not necessarily a trained one, but a person familiar with the subject-matter of Home Economics—would relieve the office and enable us to meet the increasing demands on the Library and Loan Collection. We sincerely hope that it will not be necessary to drop any of our work.

There have been so staff changes in the past year. I beg to acknowledge the efficient work of the other members of the Home Economics staff, and the assistance given us by other departments of the College.

Respectfully submitted,

MARY URIE WATSON.

PART XVII.

THE PROFESSOR OF MANUAL TRAINING.

To the President of the Ontario Agricultural College:

SIR,—I have the honour to submit herewith the ninth annual report of the department of Farm Mechanics and Manual Training for the year 1912.

The curriculum and the regulations of the course for the Teacher's Certificate in Manual Training have been modified with regard to the qualifications for entrance to the Manual Training Course, and in respect of their standing after graduation. The Department of Education has approved of the syllabus herewith appended:—

ONE YEAR COURSE.

THEORY: *Texts.*—"School and Society," John Dewey. "The Place of Industries in Elementary Education," K. E. Dopp. "Theory of Educational Sloyd," Otto Salomon.

School Management.—Organization and control; planning and equipping of buildings, lighting, ventilation, etc.

THESIS: On some subject in the course of study or connected therewith.

PRACTICE TEACHING: Macdonald Consolidated School, each student to give not less than six lessons—two on the construction of tools, two in mechanical drawing, and two in practical work.

CONSTRUCTION AND CONSTRUCTIVE DESIGN: Modifications of given models, relation of lines and spaces, general proportion, refinement of parts.

MECHANICAL DRAWING: 35 plates.

(*a*) The use of squares, triangles and instruments.
(*b*) Plane geometry—practical problems, lines, angles and polygons.
(*c*) Construction and use of plain scales.
(*d*) Orthographic projections of solids—three or more views.
(*e*) Cutting and oblique planes and sections.
(*f*) Isometric projection.
(*g*) Working drawing of models made.
(*h*) Tracing—blue printing.

Clay Modelling: Making rapid studies of simple natural objects, sufficient to show their character, proportion, mass, etc.

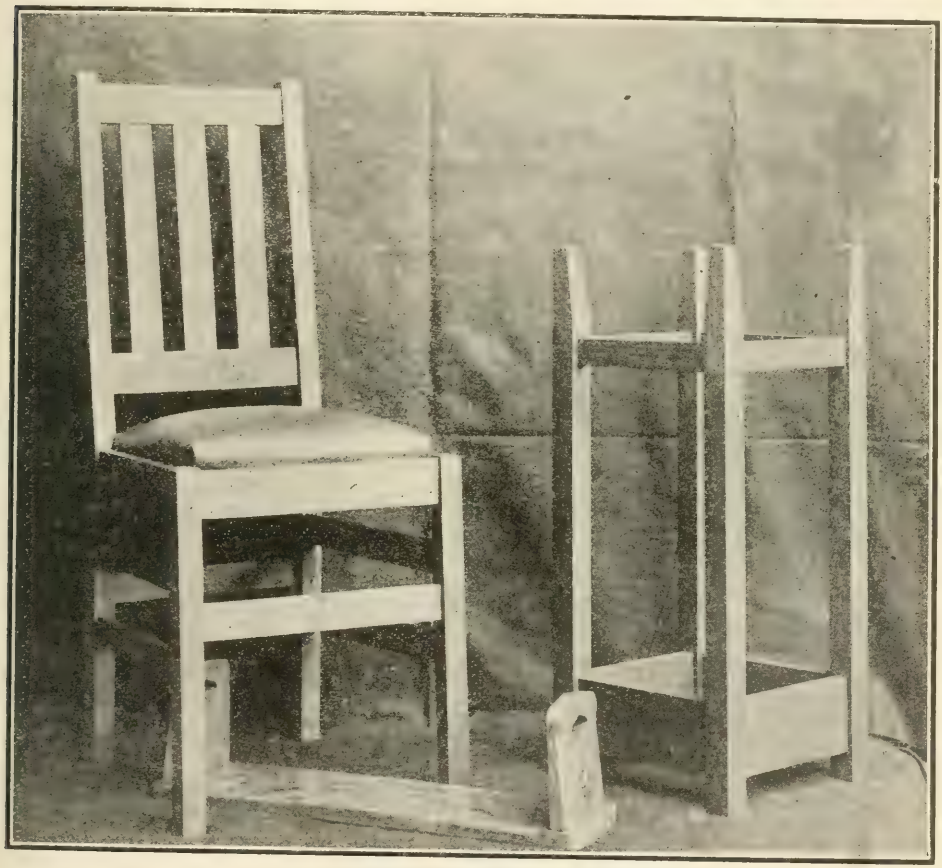
Basketry and Weaving: A short progressive course of objects, showing different methods of using materials.

Simple Woodwork: A progressive series of simple models, involving measuring, whittling, sawing, boring, and nailing. A series of six original models.

Woodworking: General course of 20 models. Technical course of 15 models, requiring a higher knowledge of construction, and demanding greater skill in manipulation of tools and materials.

Original work of at least one advanced model.

Bench Work: Exercises in making articles requiring joints, mortises, fastenings with dowels, pins, cleats, keys, wedges, glue, screws and nails.



Part of Woodworking Course.

Estimates of Cost: Calculations of the quantity of lumber required for the articles and the cost.

Tools: Their construction, use, care, and sharpening; analysis of the action of cutting tools, cutting angles, etc.

Finishing: Staining, fuming, filling, shellacing, oiling, etc., as required in finishing the articles made.

Forestry and Lumber: Observation and consideration of the properties of the lumber used, their defects, their preparation in the mills, care, etc.; structure, growth, seasoning, defects, etc., of timber.

Forging: 20 models.

Exercises in drawing out, shaping, bending, twisting, slotting, upsetting, welding and in making shoulders and collars, embodied in the construction of articles such as staples, links, bolts, nuts, rings, eyes, chains, chisels, wrenches.

MACHINE SHOP PRACTICE: 20 models.

Including chipping, filing, fitting and in finishing of work in cast iron, wrought iron and steel. Theory and practice of grinding cutting edge tools used in general machine shop practice; operation and use of lathes and drills. Screw-cutting by hand and machine. Hardening, tempering and annealing.

SHEET METALWORK: 10 models.

A short course of models, such as a cake cutter, tweezers, round box, rectangular tray, pint measure, cup and funnel, involving various methods of jointing—butt, lapped, riveted and bent joints; folding seams—cylindrical and taper; and exercises in wiring, swaging and grooving; the use of blow-pipe, soldering irons, fluxes, soft and hard solders, etc.

ART METALWORK: 20 models.

A course of models involving shaping, raising, matting, chasing, etching, soldering, brazing, riveting and coloring. Making, grinding and sharpening the smaller tools used. Original work.

The New Regulations are as follows:—

ELEMENTARY CERTIFICATES.

1. Elementary certificates in Manual Training and Household Science will be granted by the Department of Education to the following classes of students and on the following conditions:

(1) To Grade A Normal School students who have passed the final examination of the Normal Schools and have taken, from April to the end of June, the prescribed course in Manual Training at the Ontario Agricultural College, Guelph, or in Household Science at the University of Toronto, and have passed the prescribed final examinations.

(2) To other Normal School students who have taken the High School course in Manual Training or in Household Science and have passed the special examination in these subjects at the close of the High School course, who have passed the Normal School June final examination, who have taken the prescribed Summer School courses in July in Household Science at the University of Toronto, or in Manual Training at the Ontario Agricultural College, Guelph, and who have passed the prescribed final examinations.

(3) To teachers with First, Second or Third Class certificates who have taken the two prescribed Summer School courses in July in Household Science at the University of Toronto, or in Manual Training at the Ontario Agricultural College, Guelph, with directed winter's reading courses, and have passed the prescribed final examinations.

INTERIM ORDINARY CERTIFICATES IN HOUSEHOLD SCIENCE.

2. After June, 1913, only the courses in Household Science at the Macdonald Institute, Guelph, will be recognized by the Department of Education for Interim Ordinary certificates in Household Science.

3. Application for admission shall be made to the President of the Ontario Agricultural College, Guelph, not later than September 1st.

4. To be admitted, each applicant shall forward with her application the following certificates:

(1) Her professional First or Second Class certificate.

(2) A certificate from a clergyman or other competent authority that she is of good moral character.

(3) A certificate from a physician that she is physically able for the work of a teacher, and, especially, that she is free from serious pulmonary affection and from seriously defective eyesight or hearing.

5.—(1) The course shall extend over one year.

(2) On passing the final examination on the course prescribed, the candidate will be granted an Interim Ordinary certificate.

INTERIM SPECIALISTS' CERTIFICATES IN HOUSEHOLD SCIENCE.

6. Graduates in Arts in the Department of Household Science of the University of Toronto shall be entitled to an Interim Specialist's certificate in Household Science on completing the professional course at the Faculty of Education.

Permanent Certificates in Household Science.

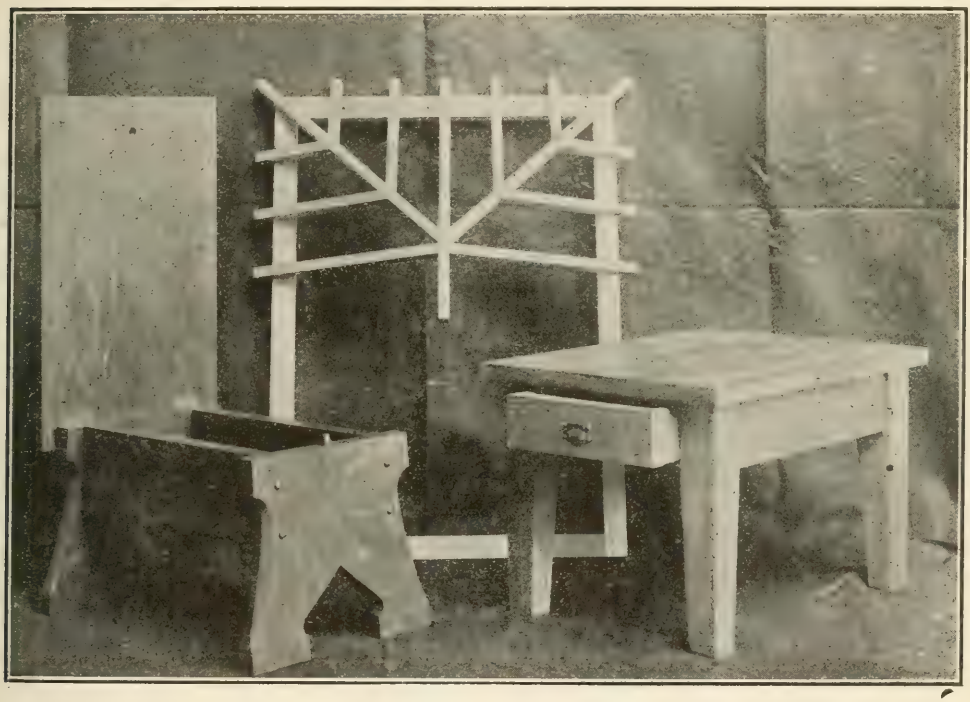
7. An Interim Ordinary or Specialist's certificate will be made permanent on the report of the Inspector that the holder has completed satisfactorily two years' service as teacher in Household Science in one or more of the schools of the Provincial system.

Interim Ordinary Certificates in Manual Training.

8. The training of teachers of Manual Training is provided for in the Macdonald Institute, Guelph.

9. Application for admission shall be made to the President of the Ontario Agricultural College, Guelph, not later than September 1st.

10. To be admitted, each applicant shall forward the certificates required from applicants for admission to the course in Household Science, as detailed in Reg. 4 above.



Part of Woodworking Course.

11.—(1) The course shall extend over one year.

(2) On passing the final examination on the course prescribed, the candidate will be granted an Ordinary Interim certificate.

Interim Specialists' Certificates in Manual Training.

12. The holder of an ordinary certificate in Manual Training who presents evidence of at least one calendar year's employment as a mechanic in a shop shall be granted an Interim Specialist's certificate in Manual Training, the evidence and character of such employment to be satisfactory to the Minister.

Permanent Certificates in Manual Training.

13.—(1) An Interim Ordinary certificate will be made permanent on the report of the Inspector that the holder has completed satisfactorily at least two years' service as a Manual Training teacher in one or more of the schools of the Provincial system, and has been employed as a mechanic in a shop for at least two months, the evidence and character of such employment to be satisfactory to the Minister.

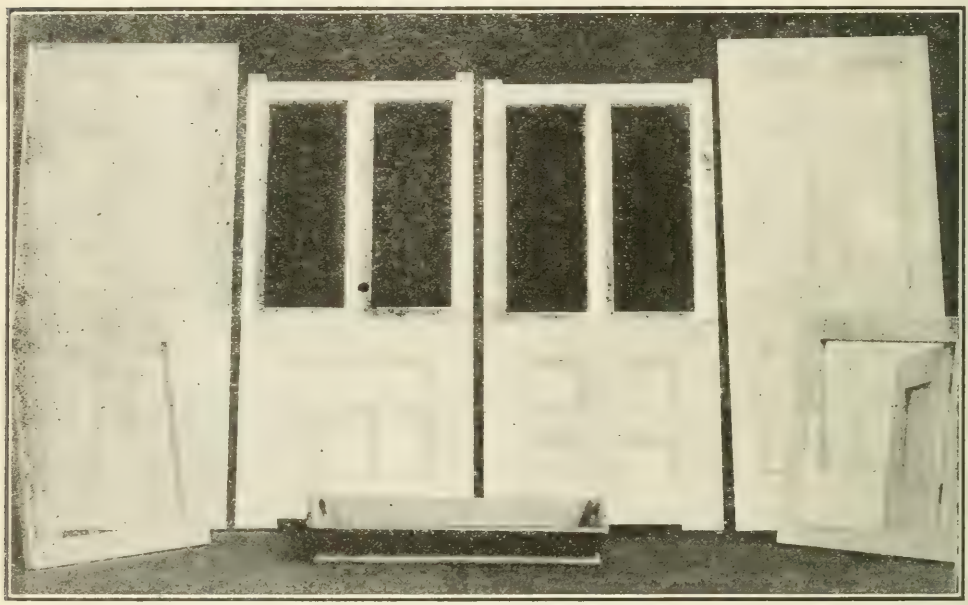
(2) An Interim Specialist's certificate will be made permanent on the report of the Inspector that the holder has completed satisfactorily two years' service as a teacher in one or more of the schools of the Provincial system.

(3) The employment prescribed in 12 and 13 (1) above may be taken at different times, and before or after the completion of the course at the Macdonald Institute.

VALUE OF CERTIFICATES IN HOUSEHOLD SCIENCE AND MANUAL TRAINING.

14.—(1) With the approval of the Minister, the Elementary certificates in Manual Training and Household Science shall be valid in Rural or Village Public or Separate Schools where most of the teacher's time is given to the general work of the school programme.

(2) The certificates in the Industrial Arts, granted heretofore, are of the same value as the elementary certificates in Manual Training to be granted under these regulations.



Part of Woodworking Course.

15. Any person holding an Ordinary or Specialist's certificate in Household Science or Manual Training shall be legally qualified to teach that subject in any of the schools of the Province, but specialists shall have the preference in appointments to the staffs of the Collegiate Institutes, and, as soon as the supply is adequate, Specialists alone shall be qualified to hold positions in Collegiate Institutes.

EXEMPTIONS.

16. The foregoing Regulations in regard to the courses and certificates in Household Science and Manual Training shall not affect the status of anyone now qualified as a teacher in either of these departments under the Regulations of the Department of Education, or the claims of any students who have commenced courses under the old regulations, provided they complete them by July, 1913.

NOTE.—The Syllabuses of the various courses may be obtained as follows:

From the Registrar of tne University of Toronto, the Syllabuses of the courses for Elementary and for Specialists' Certificates in Household Science; and, from the President of the Ontario Agricultural College, Guelph, the Syllabuses of the courses for all the certificates in Manual Training and for the Ordinary Interim certificates in Household Science.

Instructions and Regulations.

Instructions may be issued by the Minister of Education from time to time to Inspectors or other officers in carrying out the provisions of these Regulations.

All former Regulations of the Department of Education that are inconsistent with these are hereby repealed.

Winter Term.

During the Winter term 144 First Year students received instructions in practical Woodworking and Drawing; 44 in Colour and Design; 97 Short Course students in gasoline engine and 4 in the regular Manual Training subjects.

Spring Course.

The ten weeks' course in Industrial Arts was attended by only four students, viz.,

Jennie Jenkins, Woodstock, Oxford County.
S. Ethleen Johns, Hampton, Durham County.
L. A. Shier, Vroomanton, Ontario
Eva H. Patton, Harrisburg, Brant County.

Each completed the course as detailed in my last report. The character of the work done by these students was highly satisfactory and they were recommended to the Department of Education for the certificate in Elementary Industrial Arts.

There were also in attendance 7 Normal Manual Training students, and 24 students in Colour and Design.

Summer School.

There were fifty-six teachers present at the Summer School this year. The members of the class, and the subjects taken up by each are given below:

Art and Constructive Work.

1. Caskey, Miss Annie, Frankford, Hastings, Ont.
2. Schmidt, Miss A., Berlin, Waterloo, Ont.
3. Brain, M., Brampton, Peel, Ont.
4. Foster, Miss M. M., Guelph, Ont.
5. Richardson, Mr. W. L. C., Peterboro, Peterboro, Ont.
6. Yenney, Mr. H. A., Peterboro, Peterboro, Ont.
7. Grieve, Mr. H. M., Guelph, Wellington, Ont.
8. Bell, Miss Jessie M., Tavistock, Oxford, Ont.
9. Cornforth, Miss Mary E., 18 McIntyre Street, St. Thomas, Ont.
10. Davis, Miss Margaret, Elcho, Ont.
11. Davis, Miss Blanch E., Vinemount, Ont.
12. Douglas, Miss Effie, Box M., Acton, Ont.
13. Duncan, Miss Lottie, Keady, Ont.
14. Fell, Bella, Box 471, Welland, Ont.
15. Fry, Miss Annie R., Jordan, Ont.
16. Fuller, Miss E. J., 59 Winchester St., Toronto, Ont.
17. Humphries, Miss Wilna M., 2 Harrison Ave., Guelph, Ont.
18. Kottmeier, M. L., Port Robinson, Ont.
19. Lacey, Miss Bessie, Sydenham, Ont.
20. Lanskail, Miss Agnes M., 354 Huron St., Toronto, Ont.
21. MacKellar, Miss Georgina, Alvinston, Ont.
22. MacKellar, Miss Mary A., Alvinston, Ont.
23. McArthur, J. E., Gobles, Ont.

24. Magnus, Mr. A. B., Penetanguishene, Ont.
25. Mortimer, Miss M. Grace, Guelph, Ont.
26. Ronton, Miss Eva A., Dromore, Grey, Ont.
27. Scott, Miss Ethel, Port Hope, Ont.
28. Stanley, Miss Hattie J., Balderson, Ont.
29. Stewart, Miss Marion I., Homer, Ont.
30. Tuer, Miss Margaret, Port Hope, Ont.
31. Watson, Miss Vesta A., Box 411, Goderich, Ont.
32. Webster, Miss Jeab, Preston, Ont.
33. Woodrow, Miss Annie B., R.R. No. 2, Woodstock, Ont.
34. Chambers, J. E., North Bay, Ont.

WOODWORK.

1. Eberhardt, Miss Mary A., St. Catharines, Lincoln, Ont.
2. Shanette, K. M., Williamsburg, Dundas, Ont.
3. Patton, Miss Eva, Harrisburg, Brant, Ont.
4. Griffin, Rev. A. K., Eglinton, Ont.
5. Carter, J. J., Ottawa, Carleton, Ont.
6. Ingram, H. L., Belleville, Hastings County, Ont.
7. Milne, J. W., Toronto, Ont.
8. Sayers, J. R., Cherry Valley, P. E. County, Ont.
9. Wilson, A. C., Brampton, Peel, Ont.
10. Myers, J. A., Mitchell, Perth, Ont.

METALWORK.

1. Mann, W. S., Toronto, Ont.
2. Slaughter, E., Saskatoon, Sask.
3. Phelan, F. J., Consolidated School, Guelph, Wellington.
4. Moir, A., London, Ont.

CARDBOARD WORK.

1. Jenkings, T. H., Brantford, Brant County, Ont.
2. Holmes, R. S., Y.M.C.A., Ottawa, Carleton, Ont.
3. Moffatt, W. J., Narva, Bruce, Ont.
4. McKim, Norval, Springford, Oxford, Ont.

MECHANICAL DRAWING.

1. Flumerfelt, W. M., Owen Sound, Ont.
2. Powers, J. T., Guelph, Wellington, Ont.
3. Brown, J. W., R. R. No. 4, Guelph, Wellington, Ont.
4. Chambers, J. E., North Bay, Ont.

Fall Term:

This term opened with

100 Second Year Agricultural students.
41 Macdonald students.
7 Manual Training students.

During the year Messrs. W. J. Moffat; Norval McKim; W. M. Flumerfelt; J. E. Chambers; F. J. Phelan; J. O. Close; Chas. Tebbutt and T. J. Power completed the full course in Manual Training and were granted the Departmental and the College Certificate. Mr. Edward Slaughter and Mr. I. S. Clubine were awarded the College certificate for work accomplished.

Machinery Hall:

Donations of farm implements were received from the Massey-Harris Co., Toronto:—

No. 3—30 tooth rake.
No. 3—Side rake, with tedder attachment, 9½ inches.
No. 7—13 tooth cultivator, 3 R. 3 H.
No. 8—Corn cultivator, S.W., 2 Sec.
Manure spreader "C," 3 H.
No. 5—11 Disc drills, 2 H.

Canadian Logging Tool Co., Ltd., Sault Ste. Marie:—

1 No. 8 Standard earth auger.

The Dominion Specialty Works, Stratford:—

1 Automatic seed grain pickler.

The Steel Trough and Machine Co., Tweed, Ont:—

1 Hog trough, 4 feet.
1 Water trough, No. 23, 8 feet.
1 Square water trough, 11 in. x 16 in. x 8 in.
1 Tank 23 x 26 x 4 feet.

To the able support given by Miss Long, and Mr. Moffatt, of the School of Practical Science, Toronto, is due largely the successful work of the Spring Course and Summer School.

I take this opportunity of thanking Prof. Wade for his valuable assistance, in the Fall Term, with the Second Year students; also, Mr. Kendell for his consistent and systematic work during the year, and those firms who have contributed to our collection of farm implements and machinery.

I have the honour to be, Sir,

Your obedient servant,

JNO. EVANS.

PART XVIII.

THE PROFESSOR OF FORESTRY.

To the President of the Ontario Agricultural College:

SIR,—I have the honor to present herewith the report of the Forestry Department for the year 1912.

The work of this department during this last year has been largely concerned with the propaganda of reforesting, the co-operative planting, and the reclamation of waste land, along with the development of the forest nursery at the Norfolk Forest Station.

NURSERIES.

The forest nursery at present contains about 980,000 plants in nursery lines and about 500,000 seedlings in seed beds.

The following is an approximate estimate of the nursery stock:—

In Nursery Lines.	
White Pine (*Pinus strobus*, L.)	350,000
Scotch Pine (*Pinus sylvestris*, L.)	325,000
Larch (*Larix americana*, Michx.)	80,000
White Cedar (*Thuja occidentalis*, L.)	25,000
Black Locust (*Robinia pseudacacia*, L.)	75,000
Black Walnut (*Juglans nigra*, L.)	25,000
Butternut (*Juglans cinerea*, L.)	15,000
Chestnut (*Castanea dentata*, Borkh.)	25,000
Soft Maple (*Acer saccharinum*, L.)	15,000
Elm (*Ulmus americana*, L.)	10,000
White Ash (*Fraxinus americana*, L.)	10,000
Miscellaneous	25,000
In Seed Beds.	
White Pine (*Pinus strobus*, L.)	250,000
Norway Pine (*Pinus resinosa*, Ait.)	100,000
White Cedar (*Thuja occidentalis*, L.)	10,000
Larch (*Larix larix, Karst.*)	10,000
White Spruce (*Picea canadensis*, Mill.)	50,000
Yellow Pine (*Pinus ponderosa*, Laws.)	25,000
Miscellaneous	30,000

DISTRIBUTION OF FOREST PLANTS.

During the season of 1912 about 350,000 plants were sent out to experimentalists. Collections of forest seedlings were also sent out from our nurseries for the Schools' Branch of the Experimental Union. The Forestry Department have sent out, up to date, over two million plants, and in almost every country of older Ontario we have at least one plantation established. Additional planting of about 50,000 plants has been done at the Forest Station in Norfolk.

Respectfully submitted,

E. J. ZAVITZ.

Fig. 1.—New tank and tower added to the nursery plant this season (1912). The tower stands on a sand ridge which has been reclaimed by planting with Scotch Pine and Jack Pine, which may be seen in the foreground.

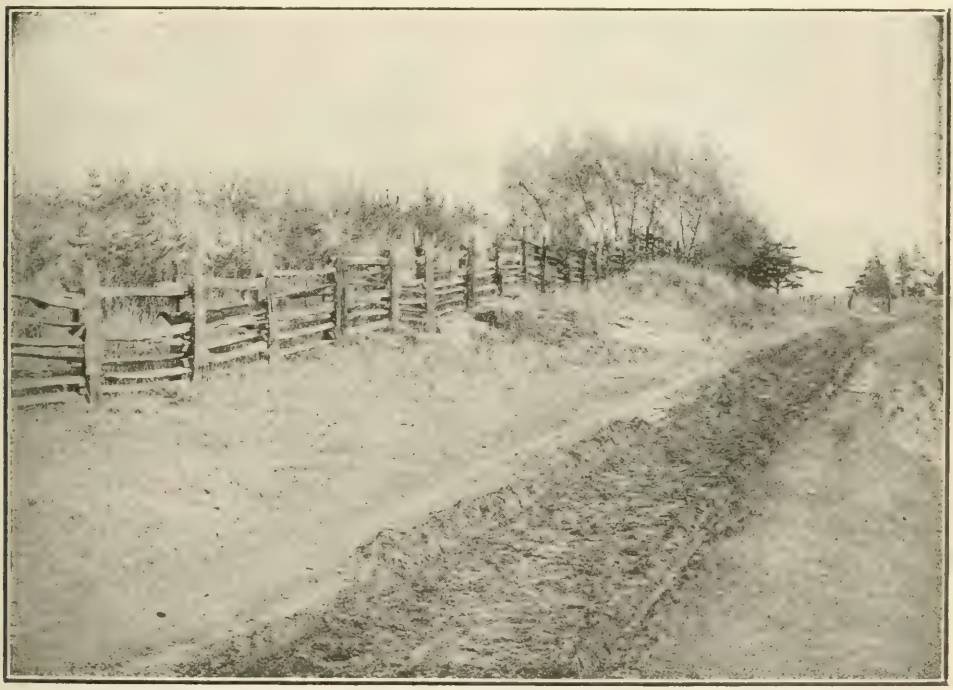


Fig. 2.—Planting done to prevent sand from encroaching on the township road. This sand knoll was planted in 1909, and has now ceased to drift.

PART XIX.

THE LECTURER ON APICULTURE.

To the President of the Ontario Agricultural College:

SIR,—

I take pleasure in presenting my Fourth Annual Report. There has been but little change in the nature of my work during the year except a healthy growth along natural lines. The work with the regular college students has been the same as in former years. The Beekeeping Short Course in January, which was well attended; extension work such as lectures at conventions and correspondence, the administration of the Ontario Foul Brood Act, Apiary Demonstrations, Fall Fair Demonstrations, and work as the Director of the Apiculture Department of the Experimental Union, filled up my time to the limit. The returns from the College Apiary are better than ever before.

THE APICULTURE SHORT COURSE.

During January, 1912, a two weeks' Short Course in Beekeeping was held, with an attendance of between forty and fifty from all parts of Ontario. Mr. P. G. Clark, of Doolittle and Clark, Marietta, N.Y., gave a series of very instructive demonstrations on Queen Breeding, and Mr. E. R. Root, Editor of "Gleanings in Bee Culture," Medina, Ohio, gave some very practical talks during the sessions of the Short Course, in addition to giving a demonstration in handling live bees and a lecture on "The Present and Future of Beekeeping," at a public meeting on Wednesday evening, January 17th. Mr. P. W. Hodgetts, Director of Fruit Branch, Department of Agriculture, Toronto, and Mr. H. G. Sibbald, of Toronto, also assisted in the programme.

In the series of lectures and demonstrations by myself during this course, I arranged to cover the same ground as is covered with the First Year Students during the Fall term. By means of these lectures and demonstrations, together with the important points brought out by a free discussion among the members of the class, we are able to provide a valuable course of instruction for advanced beekeepers, as well as for those who are just starting in the business. Other members of the staff besides myself also very kindly gave lectures to the class from day to day, adding materially to the value of the course.

THE APICULTURE CLUB.

The meetings of this club were not so well attended during the winter of 1912 as they were the previous winter. During the Fall term of 1912, however, the students who are interested in our subject reorganized the club and put forth an extra effort to bring good speakers, so that the interest in the club is of a more healthy nature than ever before. We were very much privileged by having for a speaker at one of the lectures during the Fall Mr. C. P. Dadant, editor and reviser of the College Apiculture Text Book, "Langstroth on the Honey Bee." The membership of the club is upwards of sixty, and the average attendance at meetings is about fifty.

Organization of Beekeepers.

New Beekeepers' Associations were formed in the Counties of Elgin, Prince Edward, and Grey, making now twenty County Beekeepers' Associations in affiliation with the Ontario Beekeepers' Association. The total membership of the latter organization is now upwards of six hundred. At the Annual Convention, in November, I was given the additional duty and honor of being appointed Secretary-Treasurer of the Ontario Beekeepers' Association. Over fifty apiary demonstrations were held during the season, with an average attendance of twenty-six. This work and the inspection of apiaries is fully reported in the annual report of the Ontario Beekeepers' Association.

Opportunities for Students in Apiculture.

The students who develop an interest in beekeeping during the Apiculture lectures of the first year, complain there is nothing for them after Christmas of the first year except what little they get from the club. We try to make up for this lack by giving them special training in the College Apiary during the early weeks of spring and occasionally during the summer after the regular term closes. This, of course, applies only to men going on the Apiary Inspection work in our Department. The course I have outlined for special students in Apiculture, and which I follow more or less closely as circumstances permit, is to take men who develop a special interest in bees during the first year, and either give them work in one of the College Apiaries during the vacation of the first year, or secure positions for them with practical beekeepers where they will get a season's apiary work. If they are continuing their College Course, they come to me again at the beginning of the second year summer vacation and go on as Apiary Inspectors. The first season's experience in practical work puts them in a much better position to act as Apiary Inspectors and Instructors. Before sending them out, however, I give them two or three weeks' steady drill in organized practical and class work on the detection and cure of bee diseases, also on the different questions of bee management which are sure to confront them while on their rounds. As soon as the weather permits, about May 15th, Apiary Inspection and demonstration work commences, and is continued during the summer. The services of the men who show ability and apply themselves at this work are retained as many summers as possible, and the pay is increased according to their efficiency.

Openings of two kinds offer themselves to our graduates. First, the opportunities for making a good living from beekeeping as a business are quite equal to those of any other branch of farming, and the capital required is less than in any other. Second, I find there is a great interest being awakened in most of the other Agricultural Colleges in the teaching of Apiculture, the greatest obstacle being the utter lack of men qualified to teach this subject in a College Course.

Respectfully submitted,

MORLEY PETTIT.

PART XX.

THE PROFESSOR OF NATURE STUDY.

To the President of the Ontario Agricultural College:

SIR,—I have the honor to present a brief report of the Nature Study Department for the year 1912, being the Ninth Annual Report of the Department and the eighth which I have made.

As our work is concerned largely with the teaching of Agriculture in the schools, it is proposed to report upon the work at more length in Circular 13, and issue it through the Department of Education for general distribution amongst teachers and trustees. This was done last year with satisfactory results.

The work undertaken and carried out during the year repeats in a large measure the work of the previous year. The fourth Normal Teachers' Class in Elementary Agriculture was carried out between April 20th, and June 27th, with an attendance of forty-nine teachers, four of these being men. The ninth Summer School for teachers was held from July 2nd, to August 2nd, with an attendance of one hundred and nine in the classes in Nature Study and Elementary Agriculture, fifteen of these being men. In these one hundred and fifty-eight teachers who have come thus into close touch with the work of the College at large during the year, it is hoped—and expected—that many leaders have been instructed in ways and means of redirecting the work of the schools into channels meeting the requirements of agriculture and the needs of our rural population.

As the officer in charge of the Agricultural Education Branch of the Department of Education, and necessarily carrying out my work in connection with the Agricultural College, I beg leave to thank all the members of the College staff for the unstinted help received from them in the promotion of agricultural education in the common schools.

Respectfully submitted,

S. B. McCREADY.

December 2nd, 1912.

PART XXI.

THE RESIDENT MASTER.

To the President of the Ontario Agricultural College:

SIR,—I have the honor to submit my second annual report, as Resident Master and Instructor in English, for the year 1912.

The Boys' Residence accommodates 212 students, which is the full capacity at present. On the completion of the new dining-hall this will be increased considerably when alterations are carried out. The health of the students has been excellent, no disease of any infectious nature having occurred during this fall term. The Volunteer Fire Brigade management is still in my hands, but it would be advisable to give the Engineering Department charge as soon as possible, this being recommended by Mr. Wm. Crawford, Inspector of Fire Equipment.

In my work in English with the First Year class, I assign subjects for composition, and these are corrected and returned. In lecture work I deal with the general principles of rhetoric. I also take up Irving's "Sketch Book" as a textbook.

I am, Sir, yours respectfully,

S. H. HOPKINS.

PART XXII.

THE LIBRARIAN.

To the President of the Ontario Agricultural College:

SIR,—I have the honour to submit to you the report of the Library for the year 1912.

During the year 1,030 volumes have been added to the Library. These are classified as follows:

Agricultural Reports	107	Fine Arts	17
Agriculture	52	Forestry	18
Bacteriology	30	Geology	9
Bees	4	History	22
Biography	22	Horticultural Reports	6
Botany	34	Horticulture	23
Chemistry	78	Hygiene	23
Dairy	11	Literature	74
Description and Travel	20	Manual Training	5
Domestic Animals	118	Meteorology	7
Domestic Science	27	Ornithology	2
Drawing and Decoration	6	Physics	2
Economics	48	Poultry	7
Education	34	Reference Books and General Periodicals	89
Engineering	19	Science	12
Entomology	9	Science Reports	18
Ethics and Religion	58	Zoology	5
Fiction	19		

The following books have been added to the Reference shelves:—

Canadian Men and Women of Our Times, 1911.
Mass. Board of Agriculture Reports. 45 vols.
Literature of All Nations. 10 vols.
Scientific American Reference Book, 1912.
U.S. Catalogue of Books in print, Jan. 1, 1912.
Who's Who, 1911.
Who's Who in America, 1911.

We have purchased the following sets complete to date, and will add the new volumes each year as published:

Hackney Stud Book. 29 vols.
Polled Cattle Herd Book. 36 vols.
Southdown Sheep Record. 11 vols.

From the unbound numbers of back magazines, we have had those bound that were used frequently, so as to preserve them and to make them easier to use. These are:—

Century Magazine. 11 vols., 1907 to date.
Contemporary Review. 10 vols., 1907 to date.
Fortnightly Review. 10 vols., 1907 to date.
Forum. 8 vols., 1908 to date.
Living Age. 5 vols., 1911 to date.
North American Review. 11 vols., 1907 to date.

Including these volumes we have had bound 254 volumes during the year. By purchasing text-books that are used most frequently, in the Chivers binding, we are reducing the numbers for rebinding. This is a saving both in money and in the efficiency of the book, as it is not withdrawn from circulation during the time needed for rebinding.

The circulation from Sept. 1st, 1911, to August 31st, 1912, has been 6,138, showing a steady increase over past years. This applies only to the books taken out by the students for home use, as no account can be kept of the books used in the reading rooms of the Library. The circulation was according to the following classes:—

General Periodicals	390	Agriculture	1,582
Philosophy	33	Fine Arts	83
Religion	17	Literature	800
Economics	600	Fiction	1,023
Science	966	History	164
Useful Arts	368	Biography	112

This Summer the American Library Association met in Canada for the second time, the first being in Montreal in 1900. At the meeting in Ottawa, which I had the privilege of attending, much was done to give the delegates an idea of agriculture in Canada. Dr. Robertson, as Chairman of the Local Committee gave two addresses, one at the Dominion Day session on "Conservation of Character," and the other at the special meeting for agricultural librarians. The delegates of the Association were entertained also at a garden party held at the Central Experimental Farm.

In November, the Library Institute of the Guelph district met in Fergus. At this meeting I gave a paper on the "Elements of Classification."

We wish to take this opportunity of expressing our appreciation of all our exchanges, especially those of the U. S. Department of Agriculture, and the Experiment Stations of America, Australia, Cape Colony, England, Europe, India, Japan and South America.

Respectfully submitted,

EDITH C. DWIGHT.

PART XXIII.

THE PHYSICIAN.

To the President of the Ontario Agricultural College:

SIR,—Herein I have the honor of complying with your request for my report for the year now closing.

In the sports and pastimes of the winter months a number of accidents occurred amongst both sexes, including a fractured clavicle at the Hall, and several minor injuries at the College.

The severe weather of last winter was attended by much sickness, in which the College and Hall had their full share. As in some former years we had several cases of measles, and I regret to say that we are still without quarters for the isolation of such cases. I am glad to report that all these cases made excellent recoveries except one, a superior young man who was unable to continue his studies and was obliged to return home.

The teachers in training during the summer had no grave illness amongst them, except in the case of one young lady who was too ill to remain at her work, and went home for a necessary rest.

During the autumn months the health of the students of the Hall and College has been rather above the average. In the Hall one young lady had an attack of appendicitis, and another was taken ill with chicken-pox, which happily spread no further.

At the opening of the fall term I found, as usual, a large number of students who failed to observe the regulations regarding vaccination, which I was obliged to perform for them.

Respectfully submitted,

W. O. STEWART.

GUELPH, Nov. 30th, 1912.

REPORT

OF THE

Ontario Veterinary College

1912

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO.)

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To His Honour Col. Sir John Morison Gibson, Knight Commander of the Most Distinguished Order of St. Michael and St. George, a Colonel in the Militia of Canada, etc., etc., etc.,

Lieutenant-Governor of the Province of Ontario.

May it Please Your Honour:

I have the pleasure to present herewith for the consideration of Your Honour the Report of the Ontario Veterinary College, for the year 1912.

Respectfully submitted,

JAMES S. DUFF,

Minister of Agriculture.

Toronto, 1913.

Report

OF THE

Ontario Veterinary College

1912

To the Honourable JAMES S. DUFF, *Minister of Agriculture, Toronto.*

SIR,—I have the honour to submit the following report of the Ontario Veterinary College for the year ending 31st October, 1912.

The College opened with an increase of first-year students from the previous year. It may be interesting to note the attendance from this Province has nearly doubled since the College was taken over by the Government, as will be seen by the following registration: In 1908, 49 students registered from Ontario; in 1909, 69 students; in 1910, 77 students; in 1011, 83 students; and in 1912, 85 students. During the year 363 students attended the College from various localities.

The system of teaching did not vary much from the previous year except in a most important matter, viz.; Practical illustrations before our various classes. Owing to better equipment it was possible to do more work in the line of Surgical Clinics, and class-room illustrations were very much improved by the installation of an electrical stereopticon and numerous plates of diseased as well as healthy animals.

The following programme of lectures and laboratory demonstrations was conducted at the times specified during the two terms of the College year.

FALL TERM **FIRST YEAR**

Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
8-9 A.M.	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D
9-10 "	Anatomy Room C	Sporadic Diseases of Horse Room C	Chemistry at University	Chemistry at University	Anatomy Room C	Anatomy Room C
10-11 "	Section A Laboratory Histology Room A	Section B Laboratory Histology Room A	Chemistry at University	Chemistry at University	Pharmacy Room C	Parasitology Room C
11-12 "	Section A Laboratory Histology Room A	Section B Laboratory Histology Room A	Chemistry at University	Chemistry at University	Zoology Room C	Materia Medica Room C
1-2 P.M.	Study	Study	Study	Histology Room C	Study	Study
1-4 "	Section B Laboratory Zoology Room A	Study	Study		Section A Laboratory Zoology Room A	
2-3 "	Study	Study	Study	Equine Dentistry, Room C		
1.30-3.30 "	Study	Study	Amphi-Theatre Clinic	Study	Study	
2-5 "	Section A Botany at University				Section B Botany at University	
4-5 "	Study	Study	Pharmacy Room C	Study	Study	

Zoology includes Histology and Embryology.

SUBJECT TO CHANGE

FALL TERM — SECOND YEAR

Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
8-9 A.M.	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D
9-10 "	Materia Medica. Room B	Anatomy Room B	Pathology Room D	Physiology at University	Pathology Room D	Physiology at University
10.30-11.30 "						Anatomy Room D
10-11 "	Anatomy Room B	Sporadic Diseases of Horse. RoomB	Materia Medica Room B	Anatomy Quiz 10.30-11 a.m.	Sporadic Diseases of Horse. RoomB	
11-12 "	Contagious Diseases Room B	Cattle Diseases Room B	Contagious Diseases Room B	Bacteriology Room B	Bacteriology Room B	
1-3 P.M.	Dissection					
1-5 "		Dissection	Dissection	Clinic	Dissection	Dissection
5-6 "		Physiology at University				

SUBJECT TO CHANGE

FALL TERM — THIRD YEAR

Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
8-9 A.M.	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D
9-10 "	Materia Medica Room B	Anatomy Room B	Dairy Inspection Room B	Equine Dentistry Room B	Veterinary Jurisprudence Room B	Laboratory Pathology
10-11 "	Anatomy Room B	Sporadic Diseases of Horse Room B	Materia Medica Room B	Regional Anatomy and Surgery Room B	Sporadic Diseases of Horse Room B	Canine and Feline Diseases Room B
11-12 "	Contagious Diseases Room B	Cattle Diseases Room B	Contagious Diseases Room B	Bacteriology Room B	Bacteriology Room B	Zootechnics Room B
1-4 P.M.		Clinic	Section A Microscopic Laboratory Pathology	Section B Microscopic Laboratory Pathology		
4-6 "	Section A Laboratory Bacteriology	Section A Laboratory Bacteriology	Study	Section A Laboratory Bacteriology	Section A Laboratory Bacteriology	
4.30-6 "						

SUBJECT TO CHANGE

SPRING TERM — FIRST YEAR

Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
8-9 A.M.	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D
9-10 "	Anatomy Room C	Sporadic Diseases of Horse Room C	Chemistry at University	Chemistry at University	Anatomy Room C	Anatomy Room C
10-11 "	Section A Laboratory Histology Room A	Section B Laboratory Histology Room A	Chemistry at University	Chemistry at University	Pharmacy Room C	Parasitology Room C
11-12 "	Section A Laboratory Histology Room A	Section B Laboratory Histology Room A	Chemistry at University	Chemistry at University	Zoology Room C	Materia Medica Room C
1-4 P.M.	Dissection	Dissection	Dissection	Dissection	Dissection	Dissection
	Dentistry 4-5 p.m. Room C	Study	Pharmacy 4-5 p.m. Room C	Study	Clinic 4-6 p.m. Amphitheatre	

SUBJECT TO CHANGE

SPRING TERM — SECOND YEAR

Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
8-9 A.M.	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D
9-10 "	Materia Medica Room B	Anatomy Room B	Pathology Room D	Physiology at University	Pathology Room D	Physiology at University
10-11 "	Anatomy Room B	Sporadic Diseases of Horse. RoomB	Materia Medica Room B	Anatomy Quiz Room D	Sporadic Diseases of Horse. RoomB	10.30-11.30 Anatomy Room D
11-12 "	Contagious Diseases Room B	Obstetrics Room B	Contagious Diseases Room B	Bacteriology Room B	Bacteriology Room B	
1-4 P.M.	Section A Laboratory Histology or Pathology Room A	Section B Laboratory Histology or Pathology Room A	Section A Laboratory Histology or Pathology Room A	Clinic Amphitheatre	Section B Laboratory Histology or Pathology Room A	
5-6 "		Physiology at University				

SUBJECT TO CHANGE

PRING TERM **THIRD YEAR**

Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
8-9 A.M.	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D	Tutorial Class Room D
9-10 "	Materia Medica Room B	Anatomy Room B	Sporadic Diseases Room B	Horse Shoeing, etc. Room B	Study Hour	Laboratory Pathology or Milk Inspection
10-11 "	Anatomy Room B	Sporadic Diseases of Horse Room B	Materia Medica Room B	Regional Anatomy and Surgery Room B	Sporadic Diseases of Horse Room B	Canine and Feline Diseases Room B
11-12 "	Contagious Diseases or Veterinary Hygiene Room B	Obstetrics Room B	Contagious Diseases or Veterinary Hygiene Room B	Bacteriology Room B.	Bacteriology Room B	Zootechnics Room B
1-4 P.M.	Study	1.15-2.45 p.m. Practical Work Amphitheatre	Clinic	1.00-3.30 Practical Meat Inspection 4 Students	1.00-3.30 Practical Meat Inspection 4 Students	
3-4 "	Lecture Meat Inspection Room B	Study	Lecture Meat Inspection Room B	Study	Study	Stock Judging
4-6 "	Section B Laboratory Bacteriology	Section B Laboratory Bacteriology	4.30 p.m. to 5.30 p.m.	Section B Laboratory Bacteriology	Section B Laboratory Bacteriology	

SUBJECT TO CHANGE

In addition to the above the students met at the College on Friday evenings for the discussion of essays presented by members of the Ontario Veterinary College Science Association.

The committee of the Faculty in charge of the Scholarships for the first and second year students awarded the prize for the first year to W. B. R. Knowles and the prize for the second year to F. F. Russell.

These essays present so many points of general interest to laymen as well as professionals, that it has been thought well to include them in this report, and are as follows:—

ESSAY OF THE FIRST YEAR STUDENT.

"An Obscure Case of Colic."

Amongst the many cases of interest that came under my observation last summer I think the most interesting was one of "Obstruction Colic." I never went to a case of colic without a certain amount of misgiving that the case might prove to be one of "Volvulus," "Ruptured Stomach," or some such case which might prove to have a fatal termination, but it was the frequent occurrence of the disease in its many phases and the possible fatal termination that led me to take a keen interest in any case of colic, to read all I could on the subject, and also to hold a post mortem on any fatal case.

The case I wish to bring to your notice will have a certain amount of interest to those gentlemen of the different years who saw the case about the time the college opened.

The case was reported on the morning of the 24th September, 1912, and the only history that could be obtained was that the horse, a bay gelding weighing about 1,300 lbs., showed slight signs of colic the previous afternoon and refused

his feed. He exhibited the ordinary signs of "Obstruction Colic," he would paw, sniff at his bedding, turn round several times in his stall, make numerous attempts to lie down, and finally lie down with a groan, roll, then lie stretched out, and occasionally raise his head and point the nose to the abdomen. The temperature, pulse, respirations and visible mucous membranes were normal; auscultation of both sides of the abdomen revealed marked peristalsis, and a rectal examination showed the pelvic flexure of the large colon to contain ingesta the fluid nature of which ruled an obstruction of that portion of the bowel out of question altogether, the eye was normally bright and the face did not present that haggard expression we usually see in a case which terminates fatally. The diagnosis was "An impaction or obstruction of some portion of the large colon other than the pelvic flexure." The general line of treatment was followed:

℞ Arecoline Hydrobromide, 1 gr. given subcutaneously.
Ol. Terebine, 1 oz.
Creoline, ½ oz.
Fld. Ext. Belladonna, 1 dr.
Enema of cold water per rectum.

The arecoline produced marked salivation and the animal appeared easier, but before leaving Oleum Lini., 1 pint, was administered and the owner was told to keep feed away from him and to phone if he exhibited any violent symptoms; about 3 p.m. the owner rang up and informed us the animal was worse but that he had been fairly quiet during the morning and early part of the afternoon. He was visited and found to show about the same symptoms he had shown in the morning.

Treatment.

℞ Oleum Lini., 1 pint.
Pulv. Nux. Vom., 1 dr.

On the 25th September he was visited again and found to be in about the same condition as the previous day, periods of ease would be alternated with periods in which he exhibited dull pains and restlessness. The pulse, temperature, respiration, and colour of the visible mucous membrane were still normal, auscultation revealed peristalsis about normal.

Treatment.

Arecoline Hydrobromide, 1 gr. given subcutaneously.
Eserine Sulph., ¾ gr.
Pulv. Nux. Vom., 1 dr.

There was no apparent action from the eserine, but salivation was obtained from the administration of the arecoline.

The following day, September 26th, the patient was brought to the hospital and placed in a well-bedded loose box, in order that any untoward symptoms he might show could be noted and the animal treated accordingly. At times we would find him standing perfectly quiet, and at other times he exhibited dull pains; he would also lie down after numerous attempts as before, sometimes he would roll, at other times he would be quiet, only showing pain by an occasional raise of the head and pointing the nose to the abdomen. He showed signs of thirst when the other patients were watered and was given about three-quarters of a pail of tepid water.

Treatment consisted of:

℞ Oleum Lini., 2 pints.
Pulv. Nux. Vom., 1 dr.

In the evening he was given another enema of cold water.

September 27th.—The horse was in much the same condition as the previous days, with the exception that the temperature had gone up one degree and the pulse increased to 48, but although the horse had received no food for about three and a half days, yet the abdomen was about the normal size and the flanks were not tucked up. He was given a little hay but it was eaten rather sparingly and not greedily, as one might be led to expect from such a long fast.

Treatment.

℞ Arecoline Hydrobromide, 1 gr.
Oleum Lini., 2 pints.

The condition of the horse remained much the same on September 28th, 29th, 30th, and the treatment was followed on the same lines, viz.:—

℞ Oleum Lini., 2 pints.
Pulv. Nux. Vom., 1 dr.
With copious enemas of cold water.

On October 1st it was decided to change the line of treatment and an Aloetic Ball of nine drachms was administered, together with Nux Vomica 1 dr., but with no apparent result. The condition of the horse with reference to symptoms was much the same, but the temperature had risen to 103 deg. and the pulse to 80, its tone being wiry. On October 3rd the horse was given Croton Oil Mxx, and later was taken to the dissecting-room in order that a post mortem might be held as a fatal prognosis had been given.

On October 4th, after a period of twelve days, the horse died, and on Saturday noon, October 5th, with the assistance of Mr. Theodore, I held a post mortem examination of the carcase.

On post mortem examination I found the large colon greatly distended with an ingesta of a fluid nature, the coats were very much thickened and it was impossible to get the bowels out until the carcase had been rolled on its side. The cœcum instead of containing contents of a fluid nature was impacted with a dark coloured dry ingesta. The termination of the large colon at the entrance of the floating colon revealed a calculus which weighs 2 lb. 2 oz. and four small ones about the size of an egg. There was a small calculus about the size of an egg in the floating colon about five inches from the termination of the large colon.

One of the small calculi had a nucleus which appeared to be something of the nature of a cinder or small piece of coke.

Wm. B. R. Knowles, First Year Student, O.V.C.

ESSAY OF THE SECOND YEAR STUDENT.

Anthrax.

Anthrax is an acute infectious disease occurring in all domestic animals and under favorable conditions communicable to man.

Bacteridian anthrax is the most ancient infectious disease of animals that is known, prevailing in damp undrained lands, and the history can be traced back to the times when the whole race lived under primative conditions. Records show the loss of hundreds of thousands of domestic animals and where thousands of human beings lost their lives during the year 1770. Previous to that, outbreaks in Rome and France caused the deaths of thousands of domestic animals. Later Hensinger collects evidence of its prevalence in certain areas in all parts of the world. In 1855 Pollender announced that in the year 1849 he had found in the blood of bovines affected by this disease, a considerable quantity of fine little *sticks*. These were also seen by Branell, who based his diagnosis and prognosis of the disease upon their presence, but he denied absolutely their pathogenic properties. It was in the year 1863 that Davaine recognized these elements as *bacteria* and that they constituted the specific agent for anthrax.

This bacillus to which the name "Bacillus Anthracis" was applied, as found in the blood is a nonmotile, rodshaped organism with ends apparently square, and sometimes when highly magnified a clear hyaline envelope may be seen around the bacillus. It is aerobic, the oxygen of the air being indispensable to its development.

Temperature plays a very important part in the development of the bacillus. The height of vegetation is observed at a temperature of 35°C. *Growth* stops below 12°C. and above 45°C. The bacillus survives a temperature of 45°C., but they perish in ten minutes at a temperature of 100°C. The spores are much more resistant and have survived at 130°C., and when old and dry it requires several hours at 140°C. to sterilize them. Even the bacilli are comparatively resistant to ordinary disinfectants, and has spores which form very rapidly in the carcass after death, it is always best to assume their presence in disposing of same. Sulphuric acid permanginate of potash (1-1000), carbolic acid (4-100), with hydrochloric acid (2-100) all destroy the virulence of the bacilli. Sunlight, putrification and normal gastric juice also destroy them.

Anthrax is a disease that affects nearly all animals, but young ones seem to be more susceptible. The mouse, guinea pig and rabbit are susceptible in order named, followed by sheep and horse, and these again by camel and ox. Man is less susceptible, yet contracts the disease readily by inoculation or inhalation. Swine and dogs are comparatively little susceptible, yet they often contract the disease by eating carcasses or discharges from affected animals.

Season is a contributing factor in various ways. Damp seasons sometimes bring the germ to the surface of the soil by gradual elevation of the water level, and deposits the bacilli on areas of pasture that were previously free or finally by bringing the earth worms to the surface and leading to the deposition of the bacilli in their casts brought from the infected graves or inoculated subsoils. On the other hand, dry seasons are favorable to the spreading of anthrax bacilli, as it dries up the swamps and lowlands rendering them available for pasture. The germ laden dust of these drying lands is also raised by winds and deposited on vegetation to be taken in by the animals. Another reason for summer epizootics is found in the transference of the germs by flies, crows, etc. Bollinger stated that flies and

mosquitoes carry the bacilli on their feet and piercing apparatus and even in their stomachs and transfer it from an affected animal or carcass to a healthy beast.

The bacteria may penetrate the organism by three ways: Gastro intestinal canal, lungs, or by natural orifices and abrasions in the skin. In the ox, infection takes place usually through the digestive tract and generates the form of anthrax designated by the terms: Intestinal anthrax, alimentary anthrax, anthrax apoplexy, etc. The virulent elements are taken into the mouth with forage and penetrates the buccal and pharyngeal mucous membranes. The spores sometimes resisting the acids of the stomach enter the mucous lining of the intestines.

Cutaneous infection produces cases designated under the following names: External anthrax, carbuncle disease, etc. This form, which is much more rare than the preceding one, is generally only observed in sporadic anthrax. The bacilli or spores penetrate the organism through wounds of the skin. The infection often takes place by the use of instruments or bruises, bites, and stings. Anthrax produced by inhalation is the rarest form. In this mode of infection the virulent matter is brought upon the pulmonary mucous membranes and thence into the blood stream.

The manifestations of infection by anthrax vary with the species, individuals, and according to seat of disease; whether general or local, internal or external. In the latter case the febrile and constitutional disturbances are delayed, while in internal cases the fever is early and of high type. The two common forms are subacute and acute. In the former the animal does not appear to be seriously ill and continues to feed with the herd and show life and vigor, yet there may be a temperature of 104°F. to 108°F.: pulse and breathing accelerated, heart beats tumultuous, tremors and shivering, or perhaps only starey coat, anorexia and grinding of teeth. Later there may be drooping of head and ears, dullness, stupor, and disposition to lie down; or perhaps nervous excitement and delirium. The patient becomes weak, especially behind and temperature declines to 97°F. or 94°F. prior to death. The visible mucous membranes become dusky brownish or yellow and streaks of blood many appear at nose and anus. The urine may be red, the fæces covered with mucous or blood streaks and the rectal mucosa of violet tinge. Local swellings may appear on the tongue or pharynx, even if not on surface, or colics may indicate implications of the digestive organs. Pregnant animals are liable to abort. Most cases are fatal in from 12 to 48 hours at the beginning of the outbreak, while later I have known of one or two recoveries.

The acute form involves a little more rapidly, and the duration is generally from 2 to 12 hours, twenty-four hours at the maximum. The fever becomes rapidly elevated and symptoms of anxiety, excitement, stamping, bellowing, convulsions, grinding of teeth, stupefaction, weakness, staggering gait, finally death. In other cases those of pulmonary congestion accelerated and laborious breathing, groans, cardiac palpitations; small accelerated pulse which is almost imperceptible; bloody emissions from nose and anus and death from asphyxia.

The carcass of an animal dying from anthrax soon loses rigor mortis and becomes intensely bloated. There is a bloody foam seen at nose and anus and putrification takes place rapidly. The anatomical changes produced from the effects of anthrax are briefly as follows: Hemorrhages in nearly all organs and blood-stained fluid in cavities. Sero-gelatenous infiltration in subserous and submucous connective tissues and hemorrhagic infiltration in or on the serous coats of the various organs. Tumefaction and hyperemia of liver spleen and kidneys and a sanguinous engorgement of spleen which allows the contents of the capsule to follow the laws of gravitation. The kidneys and liver are friable and show

hæmorrhagic spots on their surfaces. The neighboring lymphatic ganglion are hypertrophied, œdematous and marked by hæmorrhagic spots. Where there is infiltration of connective tissue of throat it is called gloss anthrax. The muscles vary in color, usually darker than normal and like the skin they become sprinkled with echymosis. The blood is usually dark and has a varnish like lustre with little tendency to coagulate. Burnett in his study of the blood of anthrax animals in 1904 found that the number of Red Blood Corpuscles and the percentage of Hæmo globin reduced. There was an increase in the number of lymphocytes and a decrease in the number of leucocytes.

Moore states that all foregoing lesions may be absent in very acute cases, although the specific organism is always present in the carcass. In one epidemic he saw an animal dead from sub-acute anthrax in which the blood and tissues were teaming with anthrax bacteria, yet the organs themselves macroscopically appeared to be normal. Other animals in the same outbreak exhibited the more usual *anatomical* alterations. The finding of the bacilli in the blood by microscopic examination is the only sure diagnosis of the disease and a very simple method is described by McFadgean.

It is important not to confuse anthrax with a number of non-specific disorders and accidental causes of death. The suddenness of attack and in severe cases the short duration of the disease may tend to the mistaking of it for poisoning, cerebial apoplexy, pulmonary congestion, heat apoplexy, death from lightning, or acute gastro intestinal inflammation. There are, however, certain specific diseases from which anthrax must be differentiated. The most important of these are Symtomatic anthrax (black leg) malignant odemia and scepticæmia hæmorrhagic. Rabies is not infrequently taken for anthrax.

Up to the present time the treatment for anthrax is a preventive one, and although numerous experiments have been tried to find remedies, all have thus far been unavailing. The various means adopted to prevent the spread or recurrence of anthrax consist in the removal of the animals from the infected pasture to a non-infected lot; deep burial or burning of the carcasses of dead animals; thorough disinfecting of stable or ground where animal was at time of sickness and death; destruction of germs on infected pasture if possible and immunization by vaccination.

Carcasses of animals dying or slaughtered should receive immediate attention, and to prevent further distribution of the bacilli should not be dragged about in fields or pastures to place of disposal unless proper precautions are taken. If buried, the carcass should be covered with lime and at least five feet of earth, and a covering of lime should be freely thrown over top of grave. If buried, a place where drainage to wells, creeks, etc., would be impossible should be selected.

It was first proven by Pasteur that immunity could be obtained by injecting cultures of the attenuated virus. His method consists in inoculating the animal with a small quantity of culture which has been grown at a high temperature for several days. This deprives the bacteria of their virulence. To strengthen the resistance the animals are again inoculated in ten days by a stronger virus, after which the animal is said to be immune for a duration of about six months.

On September 13th, 1912, while practising under my preceptors in the Jamestown Veterinary Hospital, New York State, I received a call by 'phone from a farm, one mile west of the town of Watts Flats, to see a cow which the owner stated was off her feed, gave no milk the night before, and acting very dull that morning. Thinking it might be a case of indigestion I filled my medicine case to treat the same and took the 8 o'clock traction car for Ashville, where I hired a

livery and drove to the farm. On entering the stable I was shown a fine five-year-old cow weighing about 1,050 lbs., occupying a box stall at the far end, which on examination showed the following symptomc:—

She stood on one side of the stall with head lowered and back slightly arched, hair starey and rough, and when I approached her made no resistance to my examination. Pulse was very weak and beating 70 times per minute, temperature 108°F. Breathing accelerated to about 28 respirations per minute; good peristalsis; slight diarrhœa with streaks of blood passing with the fæces. On inquiry into the history of the case the owner said that this cow came in with the rest of the herd the night before and nothing was noticeably wrong with her until his son tried to milk her and finding the udder empty decided that she must have been sucked by some young stock which were in the lot with the cows that day, and nothing further was noticed until he entered the stable the next morning. He noticed the cow was standing with her head down, and finding no milk in the udder he turned her into the box stall and offered her some bran which she ate none of, but she did drink a few swallows of water. I watched the animal for about thirty minutes and with the exception of a two-tenths degree rise in temperature I could not detect any further changes in symptoms. I made inquiry as to the conditions of the pasture and from what source the cattle received their drinking water, and was told that the pasture was quite damp and swampy owing to the amount of rain and they drank principally from a creek at one side of the lot not far from the buildings. I asked if he had lost any cattle in previous years from any unaccountable cause and he replied that he had not since he took possession of the farm three years ago. Although no history could be obtained of any infectious disease ever existing in the neighbourhood, I diagnosed the case as anthrax, probably due to infection from drinking water from the creek which had likely drained from some infected lands. I then informed the owner, who seemed quite ignorant of the nature of the disease, as to the danger of its spreading through the remainder of the herd, and gave the following directions in way of precaution: To remove cows from pasture they were then in and keep diseased cow from coming in *contact* with other cattle, either directly or by way of pails, mangers, etc., and to isolate any animals which appeared at any time to be going wrong. I explained to the owner that the only treatment for the disease was a preventive one and the necessity of inoculating the remaining animals as soon as possible. I left Potassium Nitrate to be given in ½ oz. doses in drinking water to affected animal, and that I should expect to find her dead by morning. I left the farm with the understanding that they should 'phone to the office the next morning if he cared for further services. On arriving home I described the case to my preceptors as I had seen it, and they told me of several outbreaks of anthrax in that neighbourhood some years ago and was of the opinion that my diagnosis was correct.

The next forenoon my preceptor received word that the cow died that morning, and that he wanted him to come and hold a post-portem and vaccinate the rest of the herd if he thought best. Inasmuch as I had started with the case the day before, I was sent to hold a post-mortem and inoculate the herd if I found it necessary. I arrived on the farm shortly after noon and found the carcass had been removed on a stone boat to a lot some 35 rods from the buildings, beside a seven foot hole dug for burial.

I prepared myself for the post-mortem with rubber gloves, overalls and frock, knife and axe. I first observed the condition of the carcass as it lay on left side, and so much distended with gas that the left fore and hind limbs were raised from the ground and a bloody exudate or foam could be seen exuding from nose and anus.

I removed the left fore limb with my knife and then with the axe cut off the ribs along the sides of the dorsal vertebræ, and splitting down between the second and third ribs with the knife I turned the left side of the carcass back, opening the thoracic and abdominal cavities. The muscles cut through thus far were dark in color and the blood oozed from the cut surfaces and showed no signs of coagulating.

I observed hæmorrhagic spots on the thoracic walls and pluera covering lungs and on cutting into the ventricles of the heart the blood flowed out forming pools in the lower half of the thoracic cavity which did not coagulate during the time I was there. The viscera and abdominal walls showed hæmorrhage infiltrations, and on removing the stomach and intestines and detaching the spleen I found it to be engorged with blood which would settle to bottom if held by one end. The capsule was spotted with dark, nearly purple infiltrations in patches as large as my hand. The liver showed slight hæmorrhagic spots externally and was very soft and friable in places. Around the kidneys was a sero-gelatinous infiltration, although the kidneys themselves were only slightly congested. The Mucous linings of bowels and stomach were of a dark brown tinge and the contents of intestines colored brown due to blood escaping through the mucous coat.

After completing the post mortem, I instructed the owner to bury the carcass without the lime, but to sprinkle a barrel over the grave and area where I had been working as soon as possible. I then returned to the stable, and after cleaning up my gloves in a creoline solution I proceeded to inoculate the remaining nineteen head each with 1 anthrax vaccine No. 1. Before and between each injection I cleaned the point of my hypodermic needle in a cup of alcohol. I told the owner to burn all bedding and fodder in the stall where the effected cow had been and disinfect all mangers and utensils with a carbolic solution and white wash.

I returned to the farm September 23rd and inoculated the same cattle with vaccine No. 2, and the owner seemed pleased with the result of previous visits and informed me that he had had no further trouble.

During the past summer I have held post mortems and vaccinated in 28 different herds, the largest total loss of any one herd being ten head out of sixteen, all of which died before or within two days after the first vaccination. I vaccinated thirty-one head at Randoph, N.Y., the last part of June, where there had been a total loss of nineteen head in ten years previous, and up to the time I left for college no outbreak had been reported on this farm. I believe from early inoculation and proper disposal of carcasses that the disease can be handled with small percentage of losses.

FAY FRANKLIN RUSSELL, Second Year Student, O.V.C.

During the month of August I attended the Convention of the American Veterinary Medical Association at Indianapolis, Ind. By request I prepared two short essays which were read and discussed at appropriate times during the meetings of the above Convention.

TOPICS RELATING TO VETERINARY EDUCATION.

The preparation of veterinary students for examinations other than those which are conducted at the various veterinary colleges, has appealed to me as a subject worthy of, perhaps, fuller consideration than has been customary in the past. Especially to those who are to a large extent responsible for the desired

training of young men, who come to an institution for the kind of education which is demanded by the public; moreover, in these days when the various sciences which are indelibly linked with veterinary education are themselves splitting up and ramifying in so many different directions, it is not easy for a college to lay out a three or even a four year course so as to meet the requirements of all sorts and conditions of the innumerable localities of so vast a territory as North America, especially in preparing students for examinations before outside boards of examiners, be they individual state boards, provincial boards, or even federal boards.

One reason for making the following suggestions is because of the great variety of text books used and authorities quoted in the daily routine of college training, that it is difficult if not impossible for a faculty to teach all the subjects of veterinary science in a three or four-year course in anything like a thorough manner, and still be in line with the teachings of the various authorities.

Another reason is that certain boards of examiners may very largely represent a particular college, consequently questions which are asked and answers which are required for a pass mark, may be entirely different from those which are taught in some other college.

Take the subject of materia medica, for instance, an examiner may be highly impressed with the efficiency of a few drugs which are unnoticed in the teaching of another, or other colleges; and his questions may all be upon the aforesaid few drugs, in which case the candidate, though well informed in this particular subject in a general way, is entirely ignorant concerning the aforesaid drugs and his examination is rejected. The foregoing principle will apply in chemistry, botany, pathology, sporadic diseases, contagious diseases, anatomy, and so on throughout the entire curriculum.

In an effort to overcome the foregoing difficulties and put the various examinations on a uniform basis I beg to suggest that a number of questions be selected for anatomy, say two hundred more or less; for materia medica, one hundred and fifty more or less; for surgery, one hundred more or less; for bacteriology, one hundred and fifty more or less; and so on for all the branches on which veterinary examinations are held. At the time the examination is to be held give each examiner a set of the questions on his special subject, letting him select ten of them, more or less, from the list, or arrange it in some way that the examination would be confined to the questions printed and distributed upon the special subject.

Another question in which veterinary education is concerned is in the preparation of calendars or catalogues for the information of intending students or others who are interested in the welfare of our profession, and in this connection I think it would be a good thing if all our colleges could be prevailed upon to publish a full list of the questions of their final examinations, together with the names of the examiners. Such a procedure would, in my opinion, give the profession at large, as well as laymen, a good idea of that which is being taught at the various colleges.

FIELD WORK IN THE TRAINING OF VETERINARY STUDENTS.

In bringing the subject of my paper before you it may be well at the outset to state what I mean by "field work" in the training of veterinary students, and will say that I mean that kind of work with which the recent graduate of a veterinary college will be brought face to face when he enters upon the duties of his

chosen profession; when, as it were, he makes his bow to the public as a full-fledged veterinarian.

I do not intend at this time to take up your time with my own opinions as to the advantages and disadvantages of laboratory training, which upon the whole I regard with great favor, for it has no doubt been thrashed out from beginning to end in every veterinary college in the land, but I will go a little beyond college training and figuratively speaking encounter our patron or client while searching for some remedy for an ailing animal. And let me say here that the future of a young man often depends upon the impression he makes at the start.

The finger marks of his college will often stamp him, but not always, therefore we must take him somewhere, where he will be in daily contact with the public, but under the cloak or screen of a perceptor, there he will learn amongst other things how to approach his patrons in every day practice, and he learns, if in good hands, how to handle different species of animals or even different animals of the same species.

In order that importance may be attached to the work under a preceptor, we have recently had prepared that which we call a preceptor's certificate, which reads as follows:

PRECEPTOR'S CERTIFICATE

for the

ONTARIO VETERINARY COLLEGE.

Toronto, Canada.

Date.....

THIS IS TO CERTIFY that .....

....
(Name in full)

practiced as a student of the ONTARIO VETERINARY COLLEGE under my supervision for ..... months during the year 19.....

.....Preceptor.

.....Residence.

Graduate of ..... Veterinary College.

Experience has led me to believe that even these condensed sheets are met with approval, both by the student and preceptor alike.

Further to increase the interest of students in preceptor's work, we have adopted the plan of giving scholarships to students, the terms of which are published in our annual calendar as follows:

SCHOLARSHIP OFFERED BY THE COLLEGE.

One to the first year and one to the second year of the course.

The student who prepares the best report on a case of disease treated by him during the summer vacation while under the supervision of a preceptor, will have the amount of his college fees for the year returned to him.

Providing, first, that the selected report of the case shall be prepared by the author in his own handwriting, and shall be read and defended before the Science Association of the Ontario Veterinary College, and accepted by the college before the award is made.

The report must be deposited at the executive office of the college, on or before October 16th.

Competition for the scholarship is open only to undergraduates of this college.

I notice on looking into the requirements as far as field work is concerned in other professions, law and medicine, that in many colleges the preceptor method of education receives much consideration. In law, the writer has recently been informed that the student is not only required to attend a certain course, but he takes another course under a preceptor, and is not permitted to take any other line of work until he has finished his law course.

The medical colleges vary a good deal, some requiring a certain amount of hospital training before the course is finished, others accept preceptor's training, while still others require both the hospital and the preceptor's work.

In our work we permit the student to write upon his final examinations, but in those cases, where the preceptor's certificate is not satisfactory, we withhold our diploma until an approved certificate is provided.

Feeling that your programme is loaded to the hilt I make my paper exceedingly brief, but trust sufficient has been said to excite the discussion of that which some day, if not at present, will become a burning question in veterinary education.

The discussion upon these short papers was spirited, and it was conceded that the various suggestions would be useful in promoting the welfare of Veterinary Science when acted upon.

BRIEF SYNOPSIS OF METHODS ADOPTED IN TEACHING VARIOUS BRANCHES OF VETERINARY SCIENCE IN THIS COLLEGE.

Contagious Diseases of Animals.—Is taught by lectures illustrated with diagrams, diseased tissues, and when possible, with infected animals.

Veterinary Hygiene.—Taught by lectures, illustrated with materials used in promoting health: and observations in the Veterinary Infirmary of the College.

Sporadic Diseases of Animals.—Embracing the various diseases which are not regarded as contagious Their causes, symptoms and treatment will be thoroughly described in lectures, illustrated with numerous specimens now in the Museum of the College, also with affected animals as they occur from time to time in the practice of the Infirmary.

Veterinary Anatomy.—Is taught first by descriptive lectures in the Class Room, and the applied science by a full course of dissection in the commodious dissecting room near the main building of the College.

Veterinary Surgery.—Is taugh first in the Class Room by illustrated lectures, and the applied science or practical work of the course is freely demonstrated in an amphitheatre fitted for the purpose.

Physiology.—Includes a course of about 60 lectures on the physiology of domestic animals, in which the following subjects are discussed, viz.: The blood and phenomena of clotting; the circulatory mechanism of the heart and blood vessels; physiology of digestion and absorption of foods; chemical characters of different foods; digestive secretions; digestions in different parts of the alimentary tract; respiration and mechanism of the organs concerned; the physiology of ductless glands; neuro-muscular mechanism; the central nervous system; the production of heat in the body and the regulation of body temperature; the central nervous system and functions of the chief parts of the brain; the physiology of the special senses; the physiology of the kidney and the other excretory organs.

Veterinary Materia Medica.—Embraces a description of the most important drugs and agents used in the cure of disease and the alleviation of pain, including their actions, uses, and doses for the various domestic animals. The practical teaching of this branch of the course is conducted in a suitable Pharmacy, as well as in the stalls of the infirmary. The lectures for the first year are largely directed to the actions and uses of medicines.

Veterinary Pathology.—The course in this subject extends over two years and includes a series of lectures and laboratory demonstrations, both macroscopic and microscopic. The lectures are divided so that general pathology is taken up the first year, and the following year is devoted to special pathology. Gangrene; degeneration; infiltrations; inflammation; tumors; cysts; hypertrophy; atrophy and bone diseases, are some of the subjects which will be discussed.

Veterinary Histology.—Is taught by illustrated Class Room lectures, all of which will be demonstrated in a spacious room for the purpose, and the student will be required to prepare, mount, stain and examine with the aid of a microscope various tissues in health, including the blood of various domestic animals.

Veterinary Obstetrics.—Is taught by a full course of lectures, illustrated with large diagrams and numerous instruments used in the practice of this most important art.

Post Mortem Demonstrations.—Is conducted by descriptive lectures and autopsies, on subjects procured for the purpose, in the amphitheatre of the College.

Bacteriology.—This branch of the College course receives full consideration numerous lectures in which special attention is given to technique in preparing and studying certain micro-organisms or germs, especially those which are believed to cause disease. The study of toxins, and the preparation of anti-toxins, vaccines and other biological products is extensively discussed and demonstrated. An extended laboratory course is given in this subject.

Chemistry.—Is taught by lectures and a course of laboratory instruction.

Zoology.—Is taught by illustrated Class Room lectures, and by laboratory methods. Much time is spend in the study of the Protozoa and the like.

Botany.—Is taught by lectures in the Class Room. The applied science is taught by laboratory methods and from specimens procured in the field.

Parasitology.—Is taught in the Class Room and the practical feature of the subject is illustrated by specimens, drawings and dissections made by the student in a laboratory equipped for that purpose.

Veterinary Dentistry.—This branch of our course is fully discussed in illustrated lectures in the Class Room, and the practical education of the student in the art is fully demonstrated in the amphitheatre.

Breeds and Breeding of Domestic Animals.—Is taught by lectures illustrated by diagrams in the Class Room, and living animals at famous Stock Yards in the vicinity of Toronto.

Meat Inspection.—Is fully taught both in the Class Room of the College, and at Abattoirs, in a manner which will be in accord with the laws and regulations of Veterinary Sanitary Science throughout the Dominion.

Horse-Shoeing.—Is fully discussed in the Class Room and practical illustrations of the art is conducted in the amphitheatre of the College.

Veterinary Jurisprudence.—Consists of a course of lectures, including a number of subjects which are important to the Veterinary Surgeon, such as contracts relating to the purchase and sale of live stock, unsoundness and vice in horses or other animals, the straying and impounding of cattle, laws relating to transportation of live stock, laws relating to the spread of malignant diseases, laws relating to diseased meats, laws of the road, the law of warranty and kindred subjects.

Dairy Inspection.—Includes lectures in the construction of the dairy barn and milk house; the care of utensils; the handling of milk from the time it is drawn from the cow until it is placed upon the market for sale. Dairy cattle in health and disease, especially those which are communicable to the human family through milk, and various other matters relating to dairy inspection.

Pharmacy.—The instruction given in this course is largely of a practical nature and students are directed in the work by an experienced teacher how to prepare as well as to care for numerous articles or drugs used in the cure of disease. Introductory lectures are also given in this course.

Embryology.—Is taught by a course of lectures in the class room and also a laboratory course including the practical study of prepared sections of Embryos of different ages.

Milk Inspection.—This course consists of twelve lectures. Normal milk is fully considered in the first two lectures. The remaining lectures are taken up with a description of methods of adulteration, tests for butter fat, description of various products of milk. Wherever possible the tests for adulterants, etc., are carried out before the class.

The calendar of the College contains full instructions for students entering, copies of examination papers, and class lists.

The new college building is now in course of erection, and when completed will be well adapted for the requirements of the present teachings of the course here.

I have the honour to be, sir,
Your obedient servant,

E. A. A. GRANGE,
Principal.

31st October, 1912.

AN ACT RESPECTING THE ONTARIO VETERINARY COLLEGE.

HIS MAJESTY, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows:

1. This Act may be cited as "The Veterinary College Act."

2. The Ontario Veterinary College heretofore established in the City of Toronto and conducted by the Ontario Veterinary College, Limited, under Letters Patent issued under the Joint Stock Companies Act, and to which certain powers were given by the former Agriculture and Arts Association, is hereby continued as The Ontario Veterinary College, under the direction of the Minister of Agriculture.

3. The said College shall be furnished with all such appliances and equipment as may be necessary for theoretical and practical training in the science and art of veterinary medicine, and in such other branches of education as may be requisite for the intelligent and successful performance of the business of a veterinary surgeon.

4. The Lieutenant-Governor in Council may appoint a Principal and such professors, lecturers and instructors as may be deemed necessary for giving instruction in the College and the promotion of its usefulness, and may pass by-laws regulating and prescribing their respective duties.

5. The Lieutenant-Governor in Council may authorise the making of arrangements whereby instruction in any of the subjects prescribed to be taught in the College may be provided by the University of Toronto or by the Ontario Agricultural College, or by any other College affiliated with the University of Toronto.

6. The government of the College shall be under and according to such rules and regulations as the Lieutenant-Governor in Council may from time to time prescribe, and such rules and regulations shall contain provisions for the standard and mode of admission; the course of study; the fees to be charged; the sessions, terms, and vacations; and such provisions as may be deemed expedient touching the conduct of students.

7. Every student upon the successful completion of the course of study, upon passing the prescribed examinations, and upon satisfactory compliance with the rules and regulations of the College, shall be admitted to the standing of a Veterinary Surgeon and shall have all the privileges and rights accorded by statute to a Veterinary Surgeon, and there shall be issued to every such student a diploma granting him the title, degree and standing of Veterinary Surgeon, such diploma to be attested by the signature of the Principal of the College and the Minister of Agriculture.

8. The Lieutenant-Governor in Council may by order make provisions whereby in case of the loss or destruction of any diploma issued by the former Agriculture and Arts Association, the former Ontario Veterinary College, Limited, or by the Minister of Agriculture, a duplicate diploma may be issued to the person entitled to the same.

9. It shall be lawful for the Lieutenant-Governor in Council in behalf of the Province to accept, hold and enjoy the gifts, bequests or devises of personal or real property or effects which any person or any government may think fit to make for the purpose of the said College.

10. The Lieutenant-Governor in Council may, if deemed advisable, appoint an Advisory Board to advise and assist the Minister of Agriculture in the management of the College, and may by Order-in-Council prescribe its duties and powers and the amounts to be allowed for the services and expenses of the members of such Board.

11. The affiliation of the College with the University of Toronto is hereby continued, such affiliation to be only to the extent of enabling the students of the said College to obtain at the examinations of the University such rewards, honors, standing, scholarships, diplomas, and degrees in Veterinary Science as the University under its statutes and the Acts of the Legislature in that behalf may be allowed to confer.

12. The Principal of the College shall at the close of each year present to the Minister of Agriculture a report upon the work of the College is such form as the Minister may approve, setting forth the staff, the course of instruction, the students in attendance, the examination results, the income and expenditure, and such general information as shall show the work being done, and this report shall be laid before the Legislative Assembly within the first thirty days of the session next ensuing.

13. The Lieutenant-Governor in Council may purchase or acquire or lease such buildings and premises as may from time to time be required for carrying on the work of the College.

14. The lease of the buildings and premises used by the said College from one Andrew Smith to the Minister of Agriculture, as representing His Majesty the King, and bearing date the twenty-eighth day of July, one thousand nine hundred and eight, is hereby approved.

15. No person or persons, association, company or organization other than is authorized under this Act shall, by advertisement or otherwise, use the name of the Ontario Veterinary College, and no person or persons, association, company or organization shall, by advertisement or otherwise, use any name similar or analogous to that of the Ontario Veterinary College, without first receiving the consent of the Minister of Agriculture in writing.

(*a*) Any person violating the provisions of this section shall, upon conviction thereof, be subject to a fine not exceeding $50 and in default of payment thereof be liable to imprisonment for not less than thirty days.

16. Section 1 of *The Act respecting Veterinary Surgeons,* is hereby repealed.

AN ACT RESPECTING VETERINARY SURGEONS.

HIS MAJESTY, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows:—

1. This Act may be cited as *The Veterinary Surgeons' Act.*

[*Note.—Sec.* 1 *repealed by* 9 *Edw. VII. c* 96, *s.* 16.]

2. Any veterinary practitioner holding the diploma of the Agriculture and Arts Association or that of the Ontario Veterinary College or any other diploma or certificate declared by the Lieutenant-Governor in Council to entitle the holder thereof to use the title veterinary surgeon, shall be entitled to professional fees in attending and Court or law as a witness in such cases as relate to the profession. R.S.O. 1897, c. 184, s. 2.

3. Any person not possessing a diploma or proper certificate from The Ontario Veterinary College or a diploma or certificate of a college whose diplomas or certificates are declared by the Lieutenant-Governor in Council to entitle the holders thereof to use the title of Veterinary Surgeon who appends to his name the term veterinary surgeon, or any abbreviation thereof, and any person who wilfully and falsely pretends to be, or who wilfully and falsely takes or uses any name, title, addition, abbreviation or description implying or calculated to lead people to infer that he is, or is recognized by law as a veterinary surgeon, within the meaning of this Act, or that he possesses a diploma or certificate from any such college, shall incur a penalty not exceeding $100, and not less than $25, recoverable under *The Ontario Summary Convictions Act.* R.S.O. 1897, c. 184, s. 3.

4. A graduate of a Veterinary College recognized by the Lieutenant-Governor in Council may practice in the Province of Ontario upon passing all the examinations of the senior class of the Ontario Veterinary College at the time and place of the annual examinations of the aforesaid Ontario Veterinary College; provided, however, that the applicant for such examination shall pay a fee of $25, and shall produce a veterinary preceptor's testimonial certifying that he has practised veterinary surgery under said preceptor for at least six months, or in lieu of said testimonial a statutory declaration certifying that the applicant has practised veterinary surgery for at least one year after graduating from such recognized Veterinary College.

5. Chapter 184 of the Revised Statutes, 1897, is repealed.

Thirty-Fourth Annual Report

OF THE

Ontario Agricultural and Experimental Union

1912

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO)

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO

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1913

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TORONTO

To His Honour SIR JOHN MORISON GIBSON, Knight Commander of the Most Distinguished Order of St. Michael and St. George, a Colonel in the Militia of Canada, etc., etc., etc.

Lieutenant-Governor of the Province of Ontario.

MAY IT PLEASE YOUR HONOUR:

I have the pleasure to present herewith for the consideration of your Honour the Report of the Agricultural and Experimental Union for 1912.

Respectfully submitted,

JAMES S. DUFF,

Minister of Agriculture.

Toronto, 1913.

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UNION MEMBERS FOR 1913.

The following list of members includes all of those who are or have been connected with the Agricultural College, and have paid the annual membership fee for the present year. It is quite distinct from the list of co-operative experimenters, of whom there are now about 6,700.

Name.	Address.
Abraham, R. H.	Chatham.
Agar, W.	Thornloe.
Aiton, R. M.	Brown's Corners.
Albright, W. D.	London.
Allen, R. J.	Toronto.
Anderson, J. F.	Raymond, Alta.
Andrew, J. F.	Lucknow.
Andrew, D. A.	Lucknow.
Atkins, E. W. M.	Guelph.
Austin, H. S.	Lynn Valley.
Baker, F. R. H.	Port Dalhousie.
Baldwin, M. M.	Colchester.
Baldwin, W. G.	Colchester.
Ballantyne, R.	Avonton.
Barratt, H. G.	Cambray.
Beckett, R. S.	Brighton.
Bennett, W.	Guelph.
Bethune, Dr.	Guelph.
Biggar, M. C.	Erie.
Blayney, T. A.	Renton.
Boddy, R. A.	Vancouver, B.C.
Bowles, M.	Fraserville.
Bowman, W.	Georgetown.
Bradshaw, B. O.	Burkeville, Va.
Braithwaite, H. A.	Unionville.
Bramhill, G.	Toronto.
Britton, J. E.	Picton.
Brook, J. H.	Otter Lake Station.
Brown, C. S.	Peterboro.
Brown, R. W.	O. A. C., Guelph.
Brown, S. P.	Coldstream.
Brush, G. H. R.	Owatonna, Minn.
Bryden, R. J.	London.
Buchan, T. A.	Drayton.
Buchanan, C. W.	Dutton.
Buchanan, D.	Thamesville.
Burrows, L. F.	Cork St., Guelph.
Butler, G. C.	Witham, Eng.
Caesar, L.	O.A.C., Guelph.
Campbell, J. A.	Simcoe.
Campbell, M. A.	Zimmerman.
Campbell, N.	Shedden.
Carncross, E. E.	Cloverdale, N.B.
Castro, H.	O.A.C., Guelph.
Carrol, D. E.	Cowal.
Chapman, F. T.	Ellesmere.
Clark, G. H.	Dept. of Agric., Ottawa.
Clark, H.	Stouffville.
Clark, T. O.	Toronto.
Clark, W.	Omemee.
Clemens, L. P.	Galt.
Coben, Henry	Kinmount.
Cohoe, D. P.	Burgessville.
Collins, G. W.	Fort William.
Connon, P. C.	O.A.C., Guelph.
Cooke, H.	Johannesburg, S.A.
Cotsworth, F. B.	New Westminster, B.C.
Creelman G. C.	Guelph.
Croskery W. M.	Kinburn.
Crow, J. W.	Guelph.
Culp, E.	Jordan Harbor.
Curran, H.	Orillia.
Cuthbertson, J. A.	Manion.
Davis, L. M.	St. Mary's.
Davison, W.	Willow Point.
Day, G. E.	Guelph.
Dean, H. H.	Guelph.
Dennis, Jas. I.	Weston, Ont.
Denton, E.	Vancouver, B.C.
Desilets, Alphonse	La Trappe, Que.
Donald, F. C.	Mandaumin.
Donaldson, J. R.	Ottawa.
Dorrance, H. A.	Orangeville.
Douglas, W. S.	Woodstock.
Dougherty, J. L.	Beachburg.
Dunlop, J. S.	St. Catharines.
Duff, Clarke	Guelph.
Duff, J. C.	Orangeville.
Edmondson, H.	Brantford.
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Edwards, S. F.	Guelph.
Edwards, W. E. J.	Essex.
Edye, W. K. C. D.	Dryden.
Elder, W. B.	Hensall.
Elderkin, J. B.	North Olmstead, O.
Elgie, R. H.	Sault Ste. Marie.
Elliott, D.	Agincourt.
Elliott, G.	Tillsonburg.
Elliott, G. A.	Wingham.
Ellis, G. C.	Ottawa.
Elton, C.	Cowley, Alta.
Evans, J.	Guelph.
Fairbairn, J. B.	Vineland.
Fairles, T. F.	Bloomington.
Farlinger, W. K.	Morrisburg.
Farmer, M. J.	Centralia.
Farncomb, H. L.	Masonville.
Ferguson, R. H.	New York, N.Y.
Ferguson, W. B.	Strathroy.
Fitzgerald, E. J.	Guelph.
Fleming, W. E.	Woodstock.
Fletcher, N. A.	Hannon.
Foreman, E. C.	Guelph.
Forsyth, Fred.	Glasgow.
Fortier, T. H.	Ottawa.
Fraser, D. B.	Edmonton, Alta.
Freeborne, S. G.	Magnetawan.
French, H. S.	Guelph.
Fry, H. S.	Vineland.
Fulmer, H. L.	Guelph.

Name.	Address.
Galbraith, A. J.	Guelph.
Gandier, S. H.	Guelph.
Gardiner, W. F.	Sarnia.
Garrett, F. A.	Tweed.
Gibson, A. L.	Guelph.
Gilmore, H. R.	Perm.
Goble, F.	Woodstock.
Goulding, N. S.	Guelph.
Graessar, F. A.	Guelph.
Graham, R. R.	Guelph.
Grindley, A. W.	Liverpool, Eng.
Grange, J. B.	Toronto.
Green, R.	Woodstock.
Gregg, A. H.	Guelph.
Gregory, C. G.	Port Dalhousie.
Griffin, D. A.	St. Williams.
Groh, H.	Preston.
Hales, J. P.	Guelph.
Hall, D.	Plattsville.
Hankinson, L. D.	Aylmer.
Harcourt, R.	Guelph.
Harcourt, J.	St. Anne.
Harding, R. H.	Thorndale.
Harkness, H. D.	Vineland Station.
Harkness, R. E.	Irena.
Harris, C. H.	Rockwood.
Harris, T. G.	Nilestown.
Harries, J. F.	Cardinal.
Hart, F. C.	Galt.
Hartman, W. J.	Bozeman, Mont.
Hearle, E.	Renton.
Hemstock, H.	Keady.
Henry, L.	Winona.
Hessel, E. C.	Vernon, B.C.
Hibberd, G. H.	College Park, Md.
Hiddleston, J.	Guelph.
High, A. M.	Killarney, Man.
Higinbotham, C. F.	Greenfield, Mass.
Hinman, R. B.	Wicklow.
Hodson, R. W.	N. Battleford, Sask.
Hoey, O.	Campbellford.
Hopkins, S. H.	Guelph.
Horobin, H. P.	Cornwall, N.Y.
Horobin, W. L.	Cornwall, N.Y.
Houlding, G.	Brantford.
Howell, J. S.	Jerseyville.
Howell, H. N.	Pelham Corners.
Howes, A.	Harriston.
Howitt, H. M.	Hamilton.
Howitt, J. E.	Guelph.
Huckett, H. C.	Guelph.
Hudson, H. F.	Ottawa.
Hunter, R.	Englehart.
Hutt, H. L.	Guelph.
Jack, Jas.	Glenmorris.
Janes, C. E.	Warwick.
Jenkins, J.	Brantford.
Jensen, E.	Guelph.
Johnson, D. M.	Myrtle Station.
Johnston R. S.	Millbrook.
Jones, D. H.	Guelph.
Jones, S. F.	London.
Jones, W. F.	Stirling.
Jowsey, H. B.	Steadman, Que.
Keegan, H. L.	Agassiz, B.C.
Keil, J.	Chatham.

Name.	Address.
Kelleher, M.	Toronto.
Keyes, A. St. V.	St. Williams.
Kingsmill, G. F.	London.
Kirk, F.	Lawrence Station.
Kirkley, F. R.	Warkworth.
Kitchen, A. F.	St. George.
Klinck, C. R.	Guelph.
Knapp, C. E.	Merrickville.
Knapp, J. S.	Merrickville.
Lackner, C.	Chesley.
Laird, J. O.	Blenheim.
Lamont, A.	Roome.
Laidlaw, C. M.	Henfryn.
Lattimer, E.	Burford.
Learmonth, C. M.	Moose Jaw, Sask.
Lennox, W. J. W.	Toronto.
Leppan, H.	Guelph.
Lindsay, J. F.	Cherry Grove.
Livingston, L.	Minesing.
Lord, L.	Penticton, B.C.
Lord, S. N.	Toronto.
Lowrie, F.	Tillsonburg.
Love, P. H.	London.
Lund, H.	Guelph.
Lyons, H. G.	Cheltenham.
Mainse, C.	Sweet's Corners.
Manton, E. R.	Mandeville, Jamaica.
Marks, W. J.	Weston.
Marcellus, F.	Guelph.
Martin, N. R.	Springfield.
Mason, A. W.	Guelph.
Mason, T. H.	Ottawa.
Miles, A. F.	Lorne Park.
Miller, E.	Troy.
Miller, H.	Arrow Park, B.C.
Mitchell, E. R. R.	Collingwood.
Monk, B. F.	Springford.
Monteith, Hon. N.	Stratford.
Moorehouse, R. L.	Cairo.
More, Jas.	Kirkton.
Morrison, R.	Wellington.
Mortimer, R. E.	Honeywood.
Murray, J. K.	Avening.
Murray, R. S.	Mimico.
McCarthy, D. J.	Kingston.
McClymont, A. C.	Wabash.
McConnell, A. D.	Grand Valley.
McCormick, J. R.	Kingscourt.
McCready, S. B.	Guelph.
McCullough, A. C.	Guelph.
McElroy, W. A.	Chesterville.
McEwen, C. F.	Byron.
McEwen, R.	Byron.
McKillop, K. L.	Eagle.
McLarty, J. E.	Rodney.
McLaurin, A. E.	Watson.
McLennan, A. H.	Guelph.
McRostie, G.	Chatham.
McQueen, M. J.	Guelph.
McVannel, A. P.	Picton.
Neale, A. R.	Nelson, B.C.
Neff, E.	Hamilton.
Neff, H. W.	Hamilton.
Neilson, J. A.	Port Dover.
Nicholson, C. S.	Orangeville.
Nixon, H. C.	St. George.
Nunnick, F. C.	Ottawa.

Name.	Address.
Orchard, Jos., Jr.	Minesing.
Ostrom, H.	Moholm, Sweden.
Owen, W. H.	Hull, Eng.
Parkhurst, C. W.	Fort Stewart.
Partridge, A. W.	Barrie.
Patterson, F. C.	Ellesmere.
Pearson, L. A.	Kintore.
Peart, R. M.	Freeman.
Pettit, M.	Guelph.
Pilkey, A. M.	Wexford.
Pope, J. C.	Regina, Sask.
Pratt, W. J.	Galt.
Puleston, L. A.	Guelph.
Putnam, G. A.	Toronto.
Raynor, T. G.	Ottawa.
Robertson, G. A.	St. Catharines.
Robinson, Eli	Stonewall, Man.
Rebsch, C.	Rowan Mills.
Reed, F.	Regina, Sask.
Reed, P. E.	Georgetown.
Reeker, F. S.	Tuscarora.
Reid, Peter	Chateauguay Basin. Que.
Revell, H. K.	Goderich.
Roger, E. C.	Motherwell.
Ross, J. G.	Montreal, Que.
Salkeld, D. G.	Goderich.
Salkeld, T. J.	Goderich.
Samson, S. J.	Grimsby.
Sanderson, T.	Byron.
Sands, R. D.	Sykestown.
Sauerbrei, M.	Toronto.
Schuyler, D.	Brantford.
Shaw, A. M.	St. Paul, Minn.
Shuttleworth, A. E.	Edmonton, Alta.
Sibbald, Wm.	Sutton West.
Sibbick, E. C.	Princeton.
Sibbitt, G. L.	Eric.
Sirett, A. W.	Rosseau.
Sirett, H.	Brighton.
Smith, J. E.	Peterboro.
Smith, R. B.	Columbus.
Smith, R. M.	Oakville.
Smith, W. R.	Lansdowne.
Smye, G. C.	Ayr.
Smylie, J. S.	Westholme, B.C.
Sorley, J. N.	Cumming's Bridge.
Southworth, W.	Guelph.
Spencer, J. B.	Ottawa.
Springer, S.	Guelph.
Squirrell, W. J.	Guelph.
Stanley, C. W.	Granton.
Stark, J. W.	Chatham.
Steele, J. A.	Almonte.
Steckle, H. S.	Strasburg.
Stewart, W. F.	Strath Gartney, P.E.I.
Stothers, S. B.	Guelph.
Stone, R. E.	Guelph.
Sutton, R. G.	Norwich.
Tawse, W. J.	Guelph.
Taylor, G. S.	Wellington.
Teece, J. H.	Enderby.
Tennant, J. L.	Renfrew.
Thompson, A. B.	Iona Station.
Thompson, W.	Westwood.
Tisdale, J.	Brampton.
Tomlinson, H.	Prince Rupert, B.C.
Toole, L.	Mt. Albert.
Vance, V.	Forest.
Vahey, P.	Newton Robinson.
Wade, R. W.	Guelph.
Wait, J. W.	Troy, Ont.
Walker, Jas.	Hepworth.
Walker, R. J. C.	Heriot Bay, B.C.
Wallace, H.	Glen Ewen, Sask.
Ware, J. T.	Allanburg.
Wass, J. M.	Granton.
Webster, H. B.	Rannoch.
Wells, E. A.	Sardis, B.C.
Weston, E.	Sarnia.
Whaley, R. C.	Brownsville.
Whale, S. C.	Goldstone.
Wheeler, H. C.	Urbana, Ill.
White, A. H.	Sardis, B.C.
White, O. C.	Ottawa.
Whiteside, A. E.	Guelph.
Whittingham, G.	Edgeley, Sask.
Whiteworth, G.	Lawrence Station.
Wiancko, T. A.	Sardis, B.C.
Widdifield, J. W.	Uxbridge.
Wilkinson, E. G.	Lindsay.
Wilkinson, P. J.	Cambray.
Williams, A. H.	Toronto.
Wilson, C. A.	Jarvis.
Wilson, G.	Oakville.
Wilson, J. P.	Epsom.
Wilson, N. F.	Rockland.
Wilson, W. H.	Toronto.
Wingfield, Geo.	Utterson.
Winslow, R. M.	Victoria, B.C.
Winter, M. H.	Wicklow.
Young, C. R.	Brigden.
Young, E.	Moose Jaw, Sask.
Young, W. W.	Brigden.
Yule, R. G.	Toronto.
Zavitz, C. A.	Guelph.
Zavitz, H. N.	Coldstream.

Ontario Agricultural and Experimental Union.

OFFICERS FOR 1913.

President ..... Lewis Toole, Mount Albert, Ont.
Vice-President ..... T. H. Mason, Department of Agriculture, Ottawa, Ont.
Secretary and Editor ..... C. A. Zavitz, Agricultural College, Guelph.
Assistant Secretary ..... W. J. Squirrell, Agricultural College, Guelph.
Treasurer ..... H. L. Hutt, Agricultural College, Guelph.
Directors ..... Dr. G. C. Creelman, Hon. Nelson Monteith, F. C. Hart, Jas. I. Dennis, H. Groh, J. H. Winslow.

Auditors ..... A. W. Mason and R. R. Graham.

Committees on Experimental Work.

Agriculture ..... C. A. Zavitz (Director), W. J. Squirrell, A. W. Mason, C. R. Klinck, and A. E. Whiteside.
Horticulture ..... J. W. Crow (Director), Elmer Lick, and R. S. Duncan.
Poultry Raising ..... W. R. Graham (Director), H. B. Webster, Jas. Hare, and J. E. Smith.
Bee-Keeping ..... Morley Pettit (Director), F. E. Millen, and W. B. Angle.
Forestry ..... E. J. Zavitz (Director), H. R. McMillan, and E. C. Drury.
Agricultural Chemistry ..... R. Harcourt (Director), J. W. Crow, and A. H. McLennan.
Agricultural Botany ..... J. E. Howitt (Director), T. G. Raynor, W. J. Lennox, and Herbert Groh.
Schools ..... S. B. McCready (Director), H. L. Hutt, C. A. Zavitz, E. J. Zavitz, Wm. Hunt, J. W. Crow, A. H. McLennan, and J. A. McDonald.

Committee on the Prevention of the Importation and the Distribution of Noxious Weed Seeds in Screenings.

G. H. Clark, R. Harcourt, C. A. Zavitz, G. E. Day, and J. E. Howitt.

TREASURER'S REPORT, 1912.

Receipts.

Balance from last year	$1,140 54
Membership fees, 371 at 50c...	185 50
Government grant	2,750 00
	$4,076 04

Expenditures.

Agricultural experiments	$1,728 19
School garden extension work.	421 24
Fertilizer experiments	121 51
Apicultural experiments	333 67
Botanical investigation	24 50
Part expenses annual meeting, 1912	90 00
Advertising meeting for 1913.	143 75
Meeting of executive	9 55
Total	$2,872 41
Balance on hand	1,203 63
	$4,076 04

We, the undersigned auditors, declare that we have audited the Treasurer's accounts and found them correct.

Robt. R. Graham,
A. W. Mason,
Auditors.

January 7th, 1913.

Ontario Agricultural and Experimental Union.

ANNUAL MEETING.

The thirty-fourth annual meeting of the Ontario Agricultural and Experimental Union was held at the Ontario Agricultural College, Guelph, on Tuesday and Wednesday, January 7th and 8th, 1913. There were in all five sessions. Besides these, there was a reception given for the ex-students of the College on Monday evening January 6th, at the home of Dr. and Mrs. Creelman, to which the College officers were invited. The reports and addresses which were presented, and the most important discussions which took place during the various sessions of the Experimental Union Meeting are embodied in this report.

SECRETARY'S REPORT.

C. A. Zavitz, Professor of Field Husbandry, O.A.C., Guelph.

In the constitution of the Ontario Agricultural and Experimental Union which was organized in 1879, a provision was made by which the members of the Association could receive samples of agricultural seeds annually for experimental purposes. In 1886 a change was made by which others than those who were members might participate in the co-operative experimental work. This feature of the Experimental Union has been an exceedingly important one, and is increasing both in magnitude and in value up to the present time.

In 1912 the co-operative work of the Experimental Union was conducted on farms throughout Ontario in agriculture, forestry, agricultural chemistry, agricultural botany, apiculture, and in connection with the public schools in elementary agriculture, horticulture, and forestry. The co-operative work in Field Husbandry has been conducted for twenty-seven years, during which time there have been 68,329 distinct tests throughout the Province. Each of these experiments consisted of from two to ten plots. The increase in the number of experimenters in agriculture can be seen from the following figures, which show the average yearly number actually engaged in the work in each of the five year periods during the last twenty-seven years, and also the number of experimenters in agriculture in 1911 and in 1912.

Five-year Periods.	Average Number of Experimenters per Annum.
1886-1890	71
1891-1895	1,060
1896-1900	2,992
1901-1905	3,379
1906-1910	4,278
1911	4,490
1912	5,027

This system of co-operative experiments in Ontario is exerting a marked influence on the agriculture of the Province. It is wholesome in its character, extensive in its operation, and far-reaching in its results.

It is proper at this time to draw particular attention to the excellent work which the experimenters are accomplishing, not only for themselves, but also for the agriculture of our Province. Besides the associates and graduates of the College, who are now farming in Ontario, a large number of leading and influential farmers of Ontario who never had the opportunity of attending an Agricultural College are also doing most commendable work. Several hundred of these experimenters have conducted experimental work successfully on their own farms in each of at least six or seven years, and are, therefore, specially trained for even better work in the future.

About 30,000 copies of the last Annual Report of the Experimental Union were printed and distributed by the Ontario Department of Agriculture in the latter part of the year. In addition to this wide distribution of the reports of experiments, we are very much pleased with the interest which has been taken in the work of the Union by the Editors of the Agricultural Journals, and by the Editors of the Agricultural Departments of several of our leading newspapers in Ontario, and even in some of the other provinces.

During the past year there have been three meetings of the Board of Control of the Experimental Union, two in January, and one in September.

Although the co-operative work of the Experimental Union has been extended over more than one-quarter of a century, it is very pleasing to know that a greater number of farmers took an active part in the work in 1912 than in any year previous. The Union is on a sound foundation and is giving most excellent service to the country. Its influence is felt in the remote sections of the Province where no Farmers' Institutes have been organized, and no Agricultural Society competitions in standing field crops have been carried out, as well as in the more thickly populated and older sections of the Province. It adds an interest to farming to those who have not had the opportunity of attending an Agricultural College, and it enables the associates and graduates of the College to keep abreast with the times. It is probably safe to say that never in the history of the organization has it been in a position to do as good work as it is at present, and we believe that as time goes on it will continue its work in a very substantial way, and will increase its influence in the betterment of agriculture.

PRESIDENT'S ADDRESS.

F. W. Goble, Woodstock.

It is with pleasure that I welcome all to this the thirty-fourth anniversary of the Ontario Agricultural and Experimental Union. We have assembled as practical investigators and we anticipate keen interest, and earnest discussion at every stage of the session. To the farmers present, we extend a cordial welcome. Your attendance here to-day encourages the members in their work, and spurs them on to greater things. The object of the Union, naturally, is to form a bond of union between students, ex-students and officers, to discuss subjects bearing on agriculture in its many phases, and to secure the co-operation of the farmers of the Province. To the ex-students, students and officers, we extend the hand

of fellowship, and trust that our meeting together shall be a pleasant and profitable one.

No doubt most of you are familiar with the development of this organization. In 1880 under the able leadership of Mr. Lewis Toole, of Mount Albert, twelve members of the Union started the first co-operative experimental work on their own farms. Since that time the work has gradually grown until in 1912, experiments were conducted on farms throughout Ontario, in Agriculture, Forestry, Agricultural Chemistry, Agricultural Botany, Apiculture, and in connection with the public schools in elementary Agriculture, Horticulture and Forestry. In Agriculture alone, 5,027 conducted experiments, testing the relative value of different varieties of grains, roots, grasses, fodder crops, fertilizers, etc., for their own immediate neighborhoods. In this way many of our most productive varieties to-day have been introduced. Such varieties as Mandscheuri and O. A. C. No. 21 barley, Siberian oats, and Dawson Golden Chaff wheat after first being tested for a number of years here, were sent out in co-operative experiments throughout the Province. From the increased yield derived from the introduction of such varieties, it is hard to calculate the monetary gain. At least, we are safe in saying that millions have been added annually to the wealth of the Province. The far-reaching influence of this Association cannot be estimated, and when we consider that over 70 per cent. of the students residing in Ontario return to the farm we feel that the influence should be ever greater. Are all of this 70 per cent. members of the Union? And if not, why not? Are we as ex-students doing all we can to foster the experimental work in our own particular locality? If we are true to our Alma Mater, surely we will have a membership in the Experimental Union, and do all in our power to help the good work along.

We have just garnered a bountiful harvest. While the summer was unusually cold and wet, a strong contrast to that of 1911, and it was extremely hard to harvest the grain and root crops in many localities, there should be no great shortage in feed until grass comes again. However, if all our arable land, not naturally drained, had been under-drained, what a vast difference in the harvest. It is not my intention to enlarge on all the benefits to be derived from under-drainage; enough to say a large increase in yields has been secured wherever tile has been properly installed. Prof. W. H. Day informs us that from returns sent in and compiled by him, drained land shows an increase of $20.00 per acre over undrained lands. We may think this hardly possible; nevertheless, it is true. Even in a hot, dry season such as we had in 1911, if land is well drained it is possible to commence seeding much earlier in the spring, and the grain gets the major part of its growth before the drouth sets in. Often we secure as much benefit from drainage in a dry season as we do in one similar to 1912. Then let us be up and doing. Delay means loss, not to mention the inconvenience and worry of crowding the season's operations into two or three weeks less time.

The farmer is a business man, and his time is valuable. Why then should he not have things as convenient on the farm as possible. In these days when farm labor is difficult to obtain, and wages are high, the labor saving devices around the barn and on the farm generally, will help to relieve the situation somewhat. Nor should the conveniences be confined to the barn. The home should have its rightful share. If we are to hold the boys and girls on the farm we must make their home as pleasant and comfortable as possible. Then they will want to stay, and will not find it "All work and no play." And surely the housewife on the farm needs every convenience in the way of water, heat and lighting, so that she will be able to

do her best work with as little fatigue as possible. It would seem rather unreasonable for the stock to have water basins, and the farmer's wife to carry water from the barn or creek. Not so long ago, the telephone was unheard of in rural homes, to-day it is quite common. The use of electricity and gas for cooking and lighting is coming more generally into use, and water in the house is quite easily installed. With these appliances at our door, and the rural mail delivery, we should have a home quite as attractive as our city cousins.

In conclusion I have to thank you for the honor you have conferred upon me in electing me to the presidency of the Union for the past year. With your assistance, I hope that these meetings may prove the most beneficial in the history of the Association. We are deeply indebted to our esteemed Secretary, Prof. Zavitz, for his untiring efforts in promoting the interests of the Experimental Union. He is doing a great work for the Province of Ontario.

W. J. LENNOX: It is certainly a surprise to me to be asked to open the discussion on the President's address. I think I may safely say that I have no criticism to offer whatever. Our president has touched upon a great many subjects in his address, points of interest to practical farmers especially. In speaking of the agriculture of the Province of Ontario and of the new methods and new machinery in the handling of the practical farm affairs, I was particularly struck with one idea that has come to my mind several times during the past year, while travelling through the Province of Ontario, namely, that we have the labor question to solve, and the new machinery at our hand. Still it seems to me that the average farmer (speaking particularly of the Province of Ontario), is working just a little more land than he can take care of. We have heard many addresses of how to keep the Ontario boy and girl on the farm. It seems to me that one of the best methods would be to cut down the size of our farms, and take a little better care of 100 acres of land instead of trying to work more of it. See that the land is properly drained, and that instead of sowing on improperly prepared land, we will put the soil in the very best shape. This would particularly apply to the weed question. We have heard of ways of fighting weeds for years and years, and it seems to me that this weed problem resolves itself into a few things, which are these, we must have well drained land, and we must have thoroughly cultivated land, and we must have pure, clean seed to sow on this land. I think if these were carried out we would have less weeds, and we would have larger production per acre over the Province of Ontario.

PROF. C. A. ZAVITZ: I think Mr. Lennox has emphasized two very strong points in regard to farming in Ontario, namely, the weed problem and the cultivation of the soil. I do not believe that the farmers of Ontario place as much importance on the cultivation of the soil as they should. I consider it one of the great weaknesses in the agriculture of Ontario at the present time. Many people put their crops in their land in too great a hurry, and do not thoroughly cultivate the soil and prepare a suitable seed bed. I have frequently been asked why it is that we get so much larger yields per acre at the College than are obtained throughout the Province. Some people imagine that we use commercial fertilizers abundantly. Let me tell you that the land on which we conduct our experiments with varieties of farm crops, selection of seed, dates of seeding, quantities of seed per acre, methods of cultivation, etc., has received no commercial fertilizers for at least twenty years, but we follow a four years' rotation, namely: grains, cultivated crops, grains, and pasture. We therefore remove from the land three crops out of every four years. We always manure the land once during the four years' rotation. Com-

mon farmyard manure is used at the rate of about twelve good sized loads (20 tons) per acre and the manure is applied before the cultivated crops are grown. This rotation and manuring appeals to the farmers of Ontario as a very reasonable one, although perhaps a little severe. My opinion is that the reasons why our crops in the Department of Field Husbandry at the College are so much better than the average crops of Ontario are because we sow seed of good quality at the right seasons in the year and on land which has been thoroughly cultivated and which is kept comparatively free from weeds. I wish to emphasize very strongly the importance of thorough cultivation and the use of the very best seed if we wish to obtain abundant returns in crop production.

T. G. Raynor: I think in the President's address there was one very important thing mentioned, and that is with regard to the conveniences of the farm home, the water supply, and having not only water ready available to turn on the tap, but having all the other conveniences that our city people have in the way of water closets and bathrooms. There is no question about it, if we are to keep the boys on the farm we must keep the girls on the farm, and those women must have these conveniences that conditions require. It might be that there are some members of the Experimental Union here who have had these conveniences in that regard. I have been in several homes where those conveniences are enjoyed, and the housewives are very well satisfied with their local conditions. I quite agree with what has been said about the tilling of too much land on the average farm, and as we have these cheap lands in the west and the speculative interest that is abroad we are going to be handicapped in getting sufficient labor to handle our farms properly. The average farmer, while he is fairly comfortably off, has too much land to work satisfactorily. The result is that he has not the time to underdrain, he has not time to work and cultivate the land in the way that Prof. Zavitz has spoken of, and the result is that in time the weeds come up. We believe that at our experimental union sessions here we can evolve some of the very best ideas that will overcome these difficulties with the weed problem.

RESULTS OF CO-OPERATIVE EXPERIMENTS IN AGRICULTURE.

C. A. Zavitz, Professor of Field Husbandry, O.A.C., Guelph.

As Director of the committee on agricultural experiments, it is my duty to again report the results of the co-operative work in Agriculture carried on throughout Ontario during the past year. In the first place I wish to express my appreciation of the work and the assistance given by the other members of the committee, viz., W. J. Squirrell, A. W. Mason, C. R. Klinck, and A. E. Whiteside. Not many people realize the large amount of work necessary in successfully conducting an extensive system of co-operative work, which reaches practically all of the townships and the neighborhoods of the Province. In 1912, there were in all forty district experiments in agriculture, including spring and fall grains, root crops, forage, fodder, silage and hay crops, culinary crops, the growing of grains, grasses and clovers in different combinations, different quantities of grain per acre, and the application of commercial fertilizers and farmyard manures with winter wheat, barley, mangels and potatoes. Most of the plots were one rod wide by two rods long, being exactly one eightieth of an acre in size. Formerly, some of the plots were considerably larger, a few being as large as one half of an acre each, but

these gave less satisfaction than the smaller plots. It is indeed, a difficult matter for the experimenters to give accurate weights of crops if they are produced on large sized plots. With the smaller plots the experiments can be kept more completely under control, and more definite results can be obtained.

At the Agricultural College, Guelph, the autumn of 1911 was about normal, the winter was very severe, the spring was somewhat cold and backward, and the summer was unusually wet and comparatively cool. These general remarks will probably apply fairly well to the greater part of the Province. The three months in which the rainfall was very heavy both at the College and throughout Ontario, were May, August and September. The rainfall was comparatively light through Ontario in the month of June, and it was about normal in the month of July. The peculiar and somewhat unusual weather conditions of the past year have been rather trying for experimental work, and many of the farmers report that their experiments were failures. Although there were a greater number experimenting this year than in any year previous, still the number of successful experiments is probably a little lower than in some other years. Such a season as this, however, has given an excellent opportunity for the experimenters and for the committee to make certain observations which they have not been able to make so completely before. The excessive rains gave favorable conditions for the development of the potato rot, and experiments have proven most interesting in bringing out the characteristics of the different varieties in their susceptibility to this disease. The different varieties of oats grew an abundance of straw, and the experimenters were enabled to observe those varieties which would stand the best under trying conditions. In very dry seasons I have heard farmers state that there was not sufficient moisture to enable the commercial fertilizers to show any direct influence on the crop. In 1912, however, there was certainly sufficient moisture to dissolve and to carry through the ground the soluble parts of the fertilizers. In these, and in many other ways the farmers who have experimented have been able to draw their own conclusions from the year's work. On the whole I think we are safe in saying that we have had a very successful year in connection with our co-operative experimental work in Agriculture.

The results of experiments and investigations obtained at the Ontario Agricultural College form the basis of both the methods of operation and the material selected for the co-operative work which is being carried on throughout Ontario. Close attention has been given to the methods used for these co-operative experiments, and printed instructions for conducting the tests, along with blank forms on which to report the results, have been forwarded to every person undertaking the work. From the beginning the co-operative experimental work of the Union has been directed and controlled by circulars and letters printed and written, which have been transmitted through the mails. Personal letters have frequently been sent to give encouragement and advice. When special visits have been made to the experimenters the object has been to enable the directors to study the difficulties of those actually engaged in the work and thus be in a better position to know the best methods to adopt in the printed instructions rather than to take any part in the immediate control of the practical operations of the experiments. We believe that this is a wise move as it places the men upon their honor and tends to bring out the best that is in them. Every man is made responsible for his own experiments, and is urged to do the very best he can for himself, and for others. A noticeable feature in connection with this work is the fact that many persons who at first took but little interest in the experiments, have afterwards

proven themselves to be most valuable experimenters and have shown great care and accuracy in the details of their work. Great care is exercised in planning the various co-operative experiments in such a way that they can be successfully undertaken by the people who are to be benefited thereby. Some experiments are comparatively simple and some are more complicated, but in every case the work is made as clear of comprehension, as definite of purpose, and as simple in method of operation as is consistent with the objects in view. It has been the constant aim to make all experiments as interesting and as instructive as it is possible to make them.

One of the direct advantages of the Experimental Union is the fact that it opens up a channel through which some of the best material of the experiments conducted at the College can be brought to the homes of the farmers. It makes direct application of the information gained at the College, by having experiments conducted on hundreds and even thousands of farms, and it systematizes the co-operative work in such a way that the results of those experiments which have been conducted with care and accuracy can be summarized and made into valuable reports for the guidance of farmers generally. The Experimental Union is not only a source of gain in dollars and cents to the farmers but it is a great educational feature which has had a very wholesome influence not only on the Agriculture of the Province, but also on the farmers themselves, who have been active in the work.

The following gives the list of the co-operative experiments in Agriculture conducted throughout Ontario in 1912:

Grain Crops.

	PLOTS
1 —Testing three varieties of Oats	3
2a—Testing O. A. C. No. 21 Barley and Emmer	2
2b—Testing two varieties of two-rowed Barley	2
3 —Testing two varieties of Hulless Barley	2
4 —Testing two varieties of Spring Wheat	2
5 —Testing two varieties of Buckwheat	2
6 —Testing two varieties of Field Peas	2
7 —Testing two varieties of Spring Rye	2
8 —Testing two varieties of Soy, Soja, or Japanese Beans	2
9 —Testing three varieties of Husking Corn	3

Root Crops.

	Plots
10 —Testing three varieties of Mangels	3
11 —Testing two varieties of Sugar Beets for feeding purposes	2
12 —Testing three varieties of Swedish Turnips	3
13 —Testing two varieties of Fall Turnips	2
14 —Testing two varieties of Carrots	2

Forage, Fodder, Silage and Hay Crops.

15 —Testing three varieties of Fodder and Silage Corn	3
16 —Testing three varieties of Millet	3
17 —Testing two varieties of Sorghum	2
18 —Testing Grass Peas and two varieties of Vetches	3
19 —Testing Rape, Kale and Field Cabbage	3
20 —Testing three varieties of Clover	3
21 —Testing two varieties of Alfalfa (Lucerne)	2
22 —Testing four varieties of Grasses	4

Culinary Crops.

23 —Testing three varieties of Field Beans	3
24 —Testing three varieties of Sweet Corn	3

FERTILIZER EXPERIMENTS.

25 —Testing fertilizers with Potatoes 6
26 —Testing fertilizers with Mangels 10
27 —Testing fertilizers with Barley 10

MISCELLANEOUS EXPERIMENTS.

28a—Testing two varieties of Early Potatoes 2
28b—Testing two varieties of Medium Ripening Potatoes 2
28c—Testing two varieties of Late Potatoes 2
29 —Testing three grain mixtures for Grain production 3
30 —Testing three grain mixtures for Fodder production 3

AUTUMN SOWN CROPS.

31 —Testing three leading varieties of Winter Wheat 3
32 —Testing two leading varieties of Winter Rye 2
33 —Testing five fertilizers with Winter Wheat 6
34 —Testing Autumn and Spring Applications of Nitrate of Soda and Common Salt with Winter Wheat 5
35 —Testing Winter Emmer and Winter Barley 2
36 —Testing Hairy Vetches and Winter Rye as Fodder Crops 2

Each farmer who wished to experiment in 1912 sent in an application for the definite experiment which he desired to carry out. In nearly all cases we were in a position to send the applicant the material for which he applied, although a few who made requests late in the season were unable to secure the varieties asked for owing to the limited supply of some of the choice material.

The reports of the co-operative experiments for 1912 which have been received have been submitted to a very critical examination. For the summary which is presented at this time only the results given in those reports which were complete in essential features and showed carefulness and reliability throughout were used. Many of these reports have been furnished by men who have had a large amount of practical experience on the farm, have had the advantages of a good education, and have had a careful training in experimental work, as they have conducted successful tests on their own farms in each of several years past. It should be remembered, that while only the good reports of carefully conducted experiments have been used for publication, many of those not included in the summary showed that the individual experimenters must have obtained a considerable amount of value from their work, and in some instances a start with choice seed of varieties particularly suited to their own farms. It occasionally happens that owing to some unavoidable accident, an experiment may have been injured to some extent so that the results could not be used in the general summary, and yet the experiment may have furnished useful lessons to the farmer conducting it. In all cases, experimenters obtain much more information from the work which they conduct than can be given in a summary report such as the one here submitted.

In the instructions for conducting the co-operative work which were furnished each experimenter, a request was made for the experimenter to give his decision as to the relative standing of the different varieties, mixtures, quantities of seed, fertilizers, manures, etc., after everything had been taken into consideration. The summary of the answers to this line of inquiry is presented in the tabulated results under the heading of comparative value.

GRAIN CROPS.

Although there has been a slight decrease in the area devoted to a few of the grain crops in Ontario in more recent years a study of the statistics of the Pro-

vince, extending over a period of thirty years, will show that on the whole the number of acres used for the production of the grain crops during recent years has been greater than that used for the same purpose formerly. Many of the grain crops are now being grown with the direct object of feeding them to stock on the farm, while formerly one of the main objects was to sell the crops from the farm for a cash value. A few of the grain crops have been increasing in area quite rapidly in recent years, and the probability is that the area devoted to the grain crops of Ontario will likely be increased rather than diminished.

It is the policy of the Department of Field Husbandry at the College to secure the best varieties of grain obtainable no matter whether obtained through importation, by selection, or as a result of cross-fertilization. After these most promising varieties of grain have made a high record in the experimental work at Guelph over a series of years they are distributed throughout Ontario for co-operative experiments. Much care, however, is exercised to distribute as few varieties as possible, but at the same time to give the farmers an opportunity of testing upon their own farms those kinds which are likely to prove the most serviceable. When a variety has given high results both at the College and throughout Ontario it is continued in the co-operative work for many years, as for instance, the Mandscheuri Barley was distributed in the co-operative scheme every season for about eighteen years, when it was found that the O. A. C. No. 21 barley had surpassed the Mandscheuri in the co-operative experiments for three or four years in succession, the Mandscheuri was dropped and the O. A. C. No. 21 is now taking its place. As the O. A. C. No. 21 is at present the most promising variety both at the College and throughout Ontario, no other variety of six-rowed barley is being distributed, but as a basis of comparison Emmer has been distributed to be tested with the barley. We are aiming to draw the attention of the farmers particularly to a few of the very best varieties, and discourage the indiscriminate use of such a very large number of varieties as are used in Ontario at the present time. New varieties are continually being introduced through seedsmen, agents, and by the farmers themselves, until we have in Ontario far too many varieties of nearly all classes of crops. We believe that as time goes on we shall centralize more and more upon a very few of the best varieties, having as few kinds as possible, but in every instance making use of such varieties that will give the highest returns in yield and in quality of crop on the particular soils on which they are grown. In order to bring this about we know of no better plan than the system which we are carrying out at present in testing a large number of varieties at the College, and then using for the co-operative work only a very few of the choice varieties for testing on the different farms of Ontario, and thus enable the farmers to continue with those kinds which are the best suited to their own particular soils and localities.

In the results here presented in tabulated form, the yield of straw as given in the second column represents the total crop, less the amount of grain, and therefore, includes the chaff with the straw. The yield of grain is given in pounds as well as in bushels per acre in order that the results may be more clearly understood, and that certain comparisons may be made between the different classes of crops as well as between the varieties of each class. While it is true that the different classes of crops were grown on different farms throughout Ontario, yet as most experiments were conducted in a large number of localities the complete table enables one to make certain comparisons of the yields of the different classes of crops. Owing to the great variation in the weight per measured bushel of the different crops, it is much easier to compare the results in pounds than in bushels

per acre. It should be understood that in working out the number of bushels per acre the standard weights per bushel has been used for each class of crop. Attention is again called to the fact that the figures in the first column, under comparative value, are made up from the answers received from the experimenters in regard to the varieties after they have taken everything into consideration.

Experiments.	Varieties.	Comparative Value.	Yield per Acre.		
			Straw (tons.)	Grain (bus.)	Grain (lbs.)
Oats (61 tests)	Siberian	100	1.68	50.16	1,706
	Regenerated Abundance	84	1.43	47.08	1,601
	Lincoln	86	1.44	46.54	1,582
Six-rowed Barley (23 tests)	O. A. C. No. 21	100	1.26	36.21	1,748
	Emmer	85	1.43	.....	1,646
Two-rowed Barley (3 tests)	Hanna	100	1.26	32.78	1.574
	Two-rowed Canadian	95	1.30	32.22	1,546
Hulless Barley (6 tests)	Guy Mayle	100	1.92	28.77	1,726
	Black Hulless	93	1.85	26.23	1,574
Spring Wheat (4 tests)	Wild Goose	100	1.09	18.00	1,080
	Hungarian	82	1.05	15.33	920
Buckwheat (5 tests)	Rye	100	1.69	37.67	1,808
	Silver Hull	78	1.69	32.83	1,576
Winter Wheat (13 tests)	Imperial Amber	100	1.52	24.30	1.458
	American Wonder	85	1.47	21.77	1,306
	Crimean Red	60	1.89	21.54	1,292
	Banatka	70	1.43	21.15	1.269
	Tasmania Red	60	1.80	20.96	1,258
Winter Rye (4 tests)	Mammoth White	100	1.89	23.93	1,340
	Common	68	1.88	19.83	1,110
Spring Rye (3 tests)	O. A. C. No. 61	100	.59	26.79	1,500
	Common	80	.46	24.47	1.370
Field Peas (20 tests)	Canadian Beauty	100	1.07	21.60	1,296
	Early Britain	83	1.03	21.53	1,292
Field Beans (12 tests)	Marrowfat	100	1.44	31.37	1,882
	Pea Bean	93	1.19	30.11	1.806
Soy Beans (2 tests)	Early Yellow	100	1.33	18.13	1,088
	Brown	76	.84	13.49	810
			Whole Crop.		
Corn for Grain (7 tests)	Genesee Valley	100	15.58	57.86	3,240
	Early California	100	11.06	54.77	3,067
	Wisconsin Little Dent	77	9.10	42.69	2,390

Varieties of Oats. The average market value of the oat crop of Ontario for the five years from 1907 to 1911 inclusive, amounted to $37,710,836 annually. It will, therefore, be seen that the oat crop is an exceedingly valuable one in Ontario. About two hundred and eighty varieties of oats have been under experiment at the Ontario Agricultural College within the past twenty-four years. New varieties have been introduced from time to time, and, after five years' tests, the poorer kinds have been dropped, and those which have given the best results have been retained in the test.

In our instruction sheets we ask experimenters to name the variety of oats which is grown most extensively in their respective counties, and as we have about five hundred experimenters with oats each year, and summarize all the answers received in regard to this enquiry, we are in a position to know something in regard to the extent to which some of the varieties are grown in Ontario at the present tme. In summarizing these answers for 1912 it was found that the most extensively grown varieties of oats grown in the Province were the Banner and the Siberian. Following these two varieties, the Ligowa, Sensation, Twentieth Century, Irish White, Tartar King, Storm King, White Jewel and Mammoth Cluster follow in order. In 1911, the varieties mentioned as the most extensively grown were in the following order: Banner, Siberian, Ligowa, Sensation, Twentieth Century, Irish White and Silver Mine. In 1910 the three most extensively grown varieties were the Banner, the Siberian and the Ligowa. It will, therefore, be seen that in each of the past three years the three most extensively grown varieties of oats in Ontario were the following: Banner, Siberian, and Ligowa, and in the order here named. Neither in 1911 nor in 1912 was any other variety, other than those here named, mentioned more than twice. The full number of varieties mentioned as being extensively grown were, 19 in 1910, 29 in 1911, and 33 in 1912.

In the spring of 1912 four varieties of oats were distributed for co-operative experiments, viz., the Siberian, Regenerated Abundance, Lincoln and Alaska. The three first named varieties were sent in the greater number of the experiments, but as the supply of Regenerated Abundance became exhausted before the applications were all filled, we used the Alaska in its place. As the last named variety, however, was used only in a comparatively small number of experiments the returns from this variety are not included in the tabulated results. The Siberian, which heads the list in yield of grain per acre throughout Ontario for 1912, has been distributed in each of nineteen years since 1892, and it has made an excellent record throughout the Province, occupying highest place in yield of grain per acre of the varieties distributed in each of thirteen years. Both the Regenerated Abundance and the Lincoln varieties were distributed in each of the past two years, and in each of those years the Siberian surpassed the Regenerated Abundance, and the Regenerated Abundance surpassed the Lincoln in grain production. In popularity, the Siberian surpassed both the Regenerated Abundance and the Lincoln in 1912. In strength of straw the Abundance and the Lincoln proved to be practically the same, but both varieties were surpassed somewhat by the Siberian, according to the reports of the experimenters. The Siberian, however, was slightly more subject to rust than either of the other two varieties.

It will be remembered that in 1911 the O. A. C. No. 72 Oats was introduced for the first time as one of the varieties for co-operative experiments. When the successful reports were received from eighty-seven experimenters throughout Ontario it was found that the O. A. C. No. 72 headed the list in both yield of grain and of straw per acre, and also in popularity amongst the experimenters. Owing to an insufficient amount of seed we were unable to distribute this variety in 1912, although the demand for it has been large. We hope to again distribute this variety in the spring of 1913. The O. A. C. No. 72 was originated at the College, and it is likely to take a prominent place as a popular oat amongst the farmers of Ontario. We expect that a number of the experimenters who received a small sample in the spring of 1911 will have a good supply of seed for sale by the end of another year.

O. A. C. No. 21 Barley, and Emmer. The barley crop of Ontario has had a market value of over eleven million dollars per annum during the past five years,

and the market value of the crop of 1911 amounted to over twelve million dollars. It is interesting to learn from the various experimenters with this crop throughout Ontario that the Mandscheuri and the O. A. C. No. 21 varieties are grown on practically 94 per cent. of the farms of Ontario. The Mandscheuri variety was imported by the College from Russia twenty-four years ago and all the barley of this variety now grown in Ontario was started from one pound which was sown at the College in 1889. The O. A. C. No. 21 was originated at the College and started from one seed which was planted in the spring of 1903. The Mandscheuri and the O. A. C. No. 21 were distributed in connection with the co-operative experiments over Ontario in each of four years, and as the former was surpassed by the latter in yield of both grain and straw per acre, in strength of straw, and in freedom from rust, the Mandscheuri has now been dropped from the list, and in each of the past three years the O. A. C. No. 21 has been distributed in its place. As no other variety obtainable has given as good all-round results as the O. A. C. No. 21 it was thought unwise to distribute any other variety of six-rowed barley, but as Emmer has made a high yield of grain per acre at the College it was considered advisable to distribute the Emmer along with the O. A. C. No. 21 in competition throughout the Province. In 1911, which was an exceptionally hot summer, the Emmer slightly surpassed the O. A. C. No. 21 barley in yield of grain. The average, however, was exceedingly small, amounting to only three pounds. In 1912 the O. A. C. No. 21 surpassed the Emmer in yield of grain per acre by 102 pounds in the average results from experiments obtained from twenty-three farms. The O. A. C. No. 21 was more popular with experimenters in each of the past two years. In strength of straw the O. A. C. No. 21 slightly surpassed the Emmer. The Emmer appeared to be entirely free from rust and the O. A. C. No. 21 nearly so, as only three farmers mentioned any rust on the O. A. C. No. 21, and in each of those cases they referred to the rust as being very slight. It is probably safe to say that, according to the results at the College and throughout Ontario, the O. A. C. No. 21 barley is the best variety of six-rowed barley under cultivation in the Province at the present time.

Two-rowed Barley. There is but little interest taken in the cultivation of two-rowed barley in Ontario. However, there is a small demand for these varieties for experimental purposes, and we have distributed both the Hanna, and the Two-rowed Canadian in each of the past three years. In 1910 we received no good reports, in 1911 only five, and in 1912 only three. In each of the past two years the Hanna has surpassed the Two-rowed Canadian in yield of grain per acre, although the yield was much less than that of the O. A. C. No. 21 six-rowed barley in each of these years.

Hulless Barley. We have a much larger demand for experimental material with the hulless than with the two-rowed barley and we have in the past few years distributed two varieties of hulless barley for testing throughout Ontario. The Guy Mayle has surpassed the Black Hulless in yield per acre in each of seven out of the last nine years, the Black Hulless surpassing the Guy Mayle in only two separate years, and then only to a very small extent.

Spring Wheat. There is practically no interest taken in spring wheat in Southwestern Ontario, but it is still grown in some counties in the Central and Eastern sections. The Wild Goose variety has been distributed for co-operative experiments in each of fifteen years, and has made a good record as compared with other varieties of spring wheat for grain production. The Hungarian has now been distributed in each of the past four years, and it has been surpassed in each of those years by the Wild Goose variety. The Hungarian is an early variety of spring wheat, which possesses good milling qualities.

Buckwheat. The percentage of increase in the area devoted to buckwheat in Ontario has been larger during the last five years than that of any other grain crop. It is a crop which will stand late seeding, is admirable for smothering weeds, and gives a very good yield of grain per acre. The varieties which are best known in Ontario are, the Common, the Silver Hull, and the Japanese. The Rye buckwheat, which is grown considerably in Nova Scotia, has not been brought into general cultivation in Ontario. It gave, however, very high yields in our experiments at the College, surpassing all other varieties. We introduced it in our co-operative experiments in 1908 for the first time, and it has now been distributed along with the Silver Hull variety in each of the past four years. The average results show that the Rye buckwheat surpassed the Silver Hull variety in yield of grain per acre by 5.5 bushels in 1908, 3.3 bushels in 1909, 6.3 bushels in 1910, 4.3 bushels in 1911, and 4.8 bushels in 1912. It will, therefore, be seen that there is a very large amount of evidence to show that the Rye buckwheat is a much larger producer of grain than the Silver Hull variety. The flour of the Rye buckwheat is somewhat yellow in appearance, and will probably not be as popular as that of the Silver Hull variety. The Rye buckwheat however, makes a very thick growth and appears to be an admirable kind for smothering weeds. It has been more popular with the experimenters than the Silver Hull variety in the co-operative experiments throughout Ontario.

Winter Wheat. In the autumn of 1911 five varieties of winter wheat were distributed for co-operative experiments throughout Ontario. The number of good reports received were much smaller than usual, owing to the partial or complete failure of winter wheat in some of the localities of Ontario. As the average of thirteen successfully-conducted experiments, the Imperial Amber occupies highest place, and the American Wonder second highest in productiveness. These were also the most popular varieties with the experimenters. The Imperial Amber is a very good all-round wheat, furnishing a flour of good quality. The Crimean Red, the Banatka, and the Tasmania Red are all wheats of very excellent quality for bread production.

Winter Rye. As in each of the past two years, the Mammoth White Winter Rye has surpassed the Common variety in the co-operative experiments. The Mammoth White has made the most excellent record of all the varieties of winter rye which have been tested at the College, and in the co-operative experiments it has not only been the highest yielder, but the most popular variety amongst the experimenters.

Spring Rye. Spring rye is grown in Ontario only to a very limited extent. In 1911 we started a co-operative experiment with spring rye for the first time. In that year we distributed a variety which we originated ourselves, and named the O. A. C. No. 61, and for comparison the Common spring rye of Ontario was included in the test. The O. A. C. No. 61 surpassed the Common variety by 89 pounds per acre in 1911, and by 130 pounds per acre in 1912. The O. A. C. No. 61 rye was the most popular with the experimenters in each of the past two years.

Field Peas. In each of the past seven years we have distributed field peas for co-operative experimental purposes. During the first four of the seven years the Early Britain made a high record. In each of the last three years, however, it has been slightly surpassed by the Canadian Beauty, although the results in 1912 are exceedingly close, there being only four pounds per acre as a difference between the two varieties. The Canadian Beauty is a large, white, smooth pea, and the Early Britain is a brown pea, but of excellent quality. According to the report of the experimenters the Early Britain seems to be rather more subject to the ravages of the

pea weevil (*Bruchus pisi*) than does the Canadian Beauty. The Canadian Beauty produces rather longer straw than the Golden Vine, and the straw is of very good quality. The Early Britain does particularly well where a straw of medium length is required, while the Canadian Beauty will thrive on a poorer soil where a longer strawed variety is desirable.

Field Beans. In 1911 there were 51,508, and in 1912, 69,703 acres of beans grown in Ontario. It is the usual custom to distribute three varieties of beans for co-operative experiments, but in 1912 only two varieties were used for this work. The Marrowfat variety has been distributed in each of fourteen years, and the results vary considerably with the season. In 1912 a comparison was made between the Marrowfat and the Small White Pea Bean, which is grown extensively as a commercial variety in Kent County. As a result of twelve successfully-conducted co-operative experiments it was found that the Marrowfat surpassed the Pea bean by an average of 76 pounds of grain per acre. The Marrowfat was rather more popular with the experiments than the Common Pea Bean.

Soy Beans. Experiments have been conducted at the Ontario Agricultural College for a number of years in testing different varieties of Soy Beans. Nearly all of these varieties have required too long a season of growth to reach maturity in Ontario. A few however, have given fairly good results. Of the named varieties which have been grown the Early Yellow has proven to be one of the best. In the co-operative experiments over Ontario for 1912 the Early Yellow surpassed the Brown variety in yield of both straw and grain per acre, and in popularity. A selection from the Early Yellow variety, which has been made at the College, is giving promising results, and is likely to be superior to the original variety.

Corn for Grain Production. In 1912 there were about 680,000 acres of corn grown in Ontario, of which about 300,000 acres were used for the growing of corn for husking. As the different varieties of corn vary so much in the time which they require to reach maturity, etc., many of them are quite unsatisfactory for grain production in Ontario. The three varieties which were selected for distribution for co-operative work in the spring of 1912 were all comparatively early maturers and high yielders of grain, as shown in the experiments at the Ontario Agricultural College. The Genesee Valley variety was obtained from James Vicks Sons, Rochester, N.Y.; the Early California Flint from L. P. Gunson & Co., Rochester, N.Y.; and the Wisconsin Little Dent from Southern Ontario. In the experiments at the College for the last six years the Early California Flint and the Wisconsin Little Dent have been two of the very highest yielders of grain. The Early California Flint is an early variety which produces corn of a yellow color and ears with twelve rows. It is, therefore, somewhat similar to the Compton's Early, but has given better results. In the average results at the College for the past six years the California Flint has surpassed the Compton's Early by about twelve bushels of shelled corn per acre per annum. In the co-operative experiments for 1912 the Genesee Valley, an Eight-rowed Yellow Flint corn, occupies highest place in yield of grain, although in popularity the Genesee Valley and the Early California Flint are equal. The Wisconsin Little Dent occupies a somewhat lower place in productiveness and in popularity as compared with either of the Flint varieties.

Sorghum. An increasing interest in sorghum has taken place in Ontario. We have had under experiment upwards of twenty varieties of sorghum at the Ontario Agricultural College. These embrace sugar canes, broom corns, kaffir corns, etc. Some of them have given very good results, indeed, while others have produced results which place the varieties at a disadvantage for cultivating in Ontario. Some

of the varieties of sugar cane are now grown in certain sections of Ontario with a good deal of satisfaction, for the production of either green or dry fodder, and to a limited extent for mixing with oats and red clover for the production of a temporary pasture. From two to three varieties of sugar cane have been distributed throughout Ontario for co-operative experiments in each of the past twelve years. The Early Amber sugar cane has given the highest yield per acre more frequently than any other variety. This variety usually gives a good yield per acre, is fairly early, and is a suitable variety for using either for the production of fodder or of pasture. We did not receive enough good reports of successfully-conducted experiments in 1912 to give a summary of this experiment in tabulated form.

Mixtures of Grain for Grain Production. A large amount of experimental work with mixed grains has been carried on at the Ontario Agricultural College. According to the report of the Bureau of Industries there were 448,402 acres of mixed grains in Ontario in 1912. This crop, therefore, is occupying a somewhat important place in the agriculture of the Province. In the experiments at the College it has been found that but little advantage can be derived from the combination of two varieties of the same kind of grain. It has also been found that varieties of certain different classes of grain can be grown in combination to marked advantage. The results of experiments show that two bushels of oats and one bushel of peas per acre makes an admirable mixture for the production of green fodder, or of hay. Other experiments show that oats and barley, of the right varieties, when grown together in the right proportions, will give a yield of about two hundred pounds of grain per acre more than either one when grown alone.

For five years in succession a co-operative experiment was conducted with different varieties of oats, barley and spring wheat, which were used in combinations of two and three kinds of grain together. The results of the five years' experiment throughout Ontario showed that one bushel of the Daubeney oats and one bushel of the Mandscheuri barley gave the highest yield of grain per acre of the different mixtures used. In each of the past three years a co-operative experiment has been conducted, testing three different proportions of oats and barley in order to secure further information as to which combination would give the largest yield on the average of the different soils in the Province. In 1910 the varieties used were the Daubeney oats and the Mandscheuri barley, in 1911, the Alaska oats and the O. A. C. No. 21 barley, and in 1912 the Daubeney oats and the O. A. C. No. 21 barley. The results of experiments up to the present time have been in favor of the combination having one bushel of oats and one bushel of barley by weight, that is, a combination of 34 pounds of oats and 48 pounds of barley, or a total of 82 pounds of the mixture per acre.

Sweet Corn for Table Use.

The object for which sweet corn is grown will determine, to a considerable extent, the character of growth most desirable in the crop. In growing sweet corn as a fodder crop for farm stock it is important to grow a variety which gives a comparatively large yield of stalks, leaves, and ears, and reaches a good stage of maturity in the locality where it is grown before there is danger of severe frost. If the corn is grown for the canning factory large, white ears of tender sweet corn are desirable, but if the sweet corn is grown for home use it is important to have grain which is very sweet, juicy and tender, and cobs which are comparatively small, and producing a rather small number of rows of grain, eight rows being the most desirable number. About fifty different varieties of sweet corn have been grown under

experiment at the Ontario Agricultural College. This has given an excellent opportunity for selecting some of the best varieties for home use. For the co-operative experiments three varieties are distributed each year to the farmers throughout Ontario that they may ascertain for themselves which are the most desirable varieties for them to use for table use. The three varieties which were distributed in the spring of 1912 were the Golden Bantam, the Mammoth White Cory, and the Malakhoff. From the numerous answers to enquiries received in 1912 it was found that the Stowell's Evergreen was the most extensively grown, and that the Mammoth White Cory was the second most extensively grown variety of sweet corn in Ontario. Following these two varieties are the Early Minnesota, and the Golden Bantam. The Stowell's Evergreen is used considerably by the canning factories, and also to a considerable extent for table use, but the ears are very large, contain many rows, and are not of as good a quality for home use as those of some of the other varieties. The following table gives the average results of seventeen tests of the three varieties of sweet corn made throughout Ontario in 1912:

Experiment.	Varieties.	Comparative Value.	Number of Ears.	Number of Days until ready for table use.	Table Quality.	
					Flavor.	Juiciness.
Sweet Corn (17 tests.)	Golden Bantam.....	100	138	96	100	100
	Mammoth White Cory..	95	136	93	81	89
	Malakhoff	67	126	91	75	77

The Golden Bantam variety of sweet corn has been distributed throughout Ontario for co-operative experiments for a number of years past, and it has made a very high record every year it has been sent out, surpassing the other varieties with which it was compared. In 1912 the Golden Bantam occupied highest place in number of ears, in flavor, and juiciness, and in popularity with the experimenters. It was three days later than the Mammoth White Cory, and five days later than the Malakhoff in reaching the proper condition for table use. The Golden Bantam possesses comparatively small eight-rowed ears, and yellow grain which is exceptionally tender, juicy and of good flavor. The Mammoth White Cory, which has been grown so extensively, has given lower results than the Golden Bantam in each year in which these two varieties have been under comparison throughout Ontario. The Malakhoff is a small growing early corn imported from Russia to Ontario through the medium of the Department of Agriculture of the United States. It has been very highly spoken of in experiments in the United States, but we find in Ontario the Golden Bantam is decidedly the better variety. When such a delicious corn as the Golden Bantam can be grown with great success in Ontario we believe that it will soon be made use of in very many of the farm homes of the Province, where it is desirable to get a high quality of corn of this character which can be used for several weeks in the latter part of the summer and the autumn, especially if it is planted at different dates.

Field Roots, Fodder Crops, Grasses, Clovers, and Alfalfa.

Co-operative experiments were conducted in 1912 with mangels, sugar beets for feeding purposes, swede turnips, fall turnips, field carrots, fodder corn, millet,

grass peas, vetches, rape, kale, field cabbage, grasses, clover, and alfalfa. The applications for a few of these experiments were quite limited, and owing to the unusual weather conditions of the past year a sufficient number of reports in a few instances have not been received to enable us to present a summary in tabulated form. In the majority of experiments, however, a sufficient number of tests were made with care and accuracy to form results of considerable value. It is difficult to get full reports of alfalfa, grasses, clovers, etc., in a way to present in the form of a table. The results of the successfully-conducted experiments with mangels, sugar beets, swede turnips, and fodder corn, are here presented in tabulated form:

Experiments.	Varieties.	Comparative Value.	Yield per Acre (tons.)
Mangels (7 tests)	Ideal	100	32.40
	Yellow Leviathan	94	31.89
	Sutton's Mammoth Long Red	88	31.05
Sugar Beets (3 tests)	Rennie's Tankard Cream	100	21.05
	Steele-Brigg's Royal Giant	88	19.08
Swede Turnips (8 tests)	Rennie's Empress	79	24.51
	Garton's Keepwell	79	22.44
	Steele-Brigg's Good Luck	100	21.45
Carrots (10 tests)	Bruce's Mammoth Intermediate Smooth White	100	22.04
	Steele-Briggs' Improved Short White	90	19.78
Fodder Corn (4 tests)	Hoopengardner's Very Early Yellow Dent	55	17.29
	Wisconsin No. 7	73	17.10
	White Cap Yellow Dent	100	17.06

Mangels. The mangel crop of Ontario is increasing in importance from year to year, while the area devoted to turnips and to carrots is greatly decreasing. The mangel crop will likely soon occupy a greater area than the turnip crop in Ontario.

There are in general cultivation in Ontario four distinct classes of mangels grown viz., the long, the intermediate, the globe and the tankard. Many farmers have the impression that the long red mangel is the highest yielder of roots per acre. We have found, however, in our experiments at the College in recent years, that the highest yielding variety of mangels has belonged to the Intermediate class and that one of the Tankard varieties is now occupying a high place.

In the spring of 1912 the seed of each of three varieties of mangels was distributed throughout Ontario for co-operative experiments. These included a long red, an intermediate, and a tankard. The seed of the tankard was grown in Germany, that of the intermediate in France, and that of the long red in England. The seed of both the tankard and the intermediate, however, was purchased in Ontario, while that of the long red was imported from England. The reports of seven tests with mangels on different farms of Ontario in 1912 show that the tankard variety, known as the Ideal, occupied highest place in yield of roots per acre; and the intermediate variety, known as the Yellow Leviathan, occupied second place in this respect; while the long red came at the bottom of the list, both in yield of roots per acre

and in popularity with the experimenters. The Yellow Leviathan has been distributed throughout Ontario in each of the past ten years, and it has out-yielded the long red variety in eight out of the ten years. The Ideal variety has been used in co-operative experiments in each of the past four years and it surpassed the Yellow Leviathan in 1909, in 1911, and in 1912. In connection with the experiments at both the College and throughout Ontario the Ferry's Yellow Leviathan Intermediate mangel and the Kirsche's Ideal have made high records.

The seed of the Yellow Leviathan mangel was first obtained by the Ontario Agricultural College from D. M. Ferry, of Windsor, Ont., in the spring of 1893. The name "Yellow Leviathan" was entered in the catalogues of some of the other seedsmen, as follows: the Steele-Brigg's Seed Co., Toronto, in 1896; Jas. Hewer, Guelph, in 1908; the Wm. Rennie Seed Co., Toronto, J. A. Simmers, Toronto, and John A. Bruce, Hamilton, in 1909: and Geo. Keith, Toronto, in 1910. In each of the past four years we have obtained seed under the name of Yellow Leviathan as advertised by a number of the Ontario seedsmen. These differnt lots have varied considerably in germinating power, shape and color. The seed which produced roots each year resembling most closely those obtained from Ferry was that obtained from Steele-Briggs Seed Co., Toronto, and from the Wm. Rennie Co., Toronto. In each of three years, however, the seed obtained from the Wm. Rennie Seed Co. gave a lower percentage of germination in the field than that under the name of Yellow Leviathan obtained from any other source. It is, therefore, important not only to secure the seed of the best variety, but also to secure seed which will grow. It is exceedingly probable that the cause of so many failures in the mangel crop of Ontario is due to the sowing of seed of poor vitality. The Seed Control Act of Ontario, which now has a section on germination of root seed, will likely exert a wholesome influence on root growing in Ontario. Any farmer may secure a copy of the Seed Control Act by writing to G. H. Clark, Seed Commissioner, Department of Agriculture, Ottawa, and the communication may be forwarded without postage. The growers of grains and roots in Ontario would find it to their interests to make a very careful study of the Seed Control Act.

Sugar Beets for Feeding Purposes. In Ontario sugar beets are grown for two distinct purposes; one for the production of sugar, and the other for the feeding of farm stock. For the one purpose, roots are grown which remain almost entirely under the ground, which are small in size, and contain a high percentage of sugar, usually averaging about fifteen per cent.; and for the other purpose, roots are of a larger size, which grow considerably out of the ground and which usually contain about eight to ten per cent. of sugar. A number of varieties of these sugar beets have been carefully tested at the Ontario Agricultural College for a number of years in succession. For co-operative work in Ontario two varieties of sugar beets were distributed in the spring of 1912. The Rennie's Tankard Cream surpassed the Steele-Brigg's Royal Giant by an average of about two tons of roots per acre.

Swede Turnips. The yield per acre of swede turnips in 1912 was considerably higher than that of 1911, the highest of 1912 being 24.5 tons per acre while that for 1911 was 17.3 tons per acre. Although the Steele-Brigg's Good Luck occupied lowest place in average yield per acre in 1912 it was more popular than either of the other two varieties in the opinion of the eight experimenters who conducted this test successfully.

Fall Turnips. There were a few applications for seed of the different varieties of fall turnips for popular experimental work, but no satisfactory reports have been received of successfully conducted tests.

Field Carrots. We have found in our experiments at the Ontario Agricultural College that the short white varieties have given an average of about five tons per acre more than the old White Belgian variety which was formerly grown considerably. The short white carrots appear under different names and, although there is a great similarity in the form of the roots, there appears to be a difference in some of the different strains, owing perhaps to the source of seed, as the production of seed seems to be influenced by locality, by soil, by selection, etc. Of the two named varieties of field carrots used in the co-operative experiments in 1912 the Bruce's Mammoth Intermediate Smooth White occupied highest place in the average yield of roots per acre and in popularity. This variety was used in the co-operative experiments in each of eight years and gave the highest yield in roots per acre in each of five years. The Steele-Brigg's Improved Short White was distributed in each of eleven years previous to 1912 and of these eleven years it occupied the highest place in yield of roots per acre in each of five years.

Fodder Corn. The area devoted to fodder corn in Ontario has been increasing quite rapidly in recent years. No one variety of fodder corn is suitable for all parts of Ontario. The results of experiments conducted at the College with a large number of varieties of fodder corn form a general guide for farmers in different parts of Ontario if they make a careful study of the different varieties. It is important, however, to carry on co-operation work to enable the farmers to find out for themselves which of the leading varieties would give the best results upon their own particular farms. For this purpose three varieties have been distributed each year and the results of experiments are watched by those who conduct the experiment.

In the spring of 1912 the Hoopengardner's Very Early Yellow Dent was distributed throughout Ontario for the second time, the White Cap Yellow Dent for the ninth time, and the Wisconsin No. 7 for the first time. The results in the accompanying table are interesting, as they show that the variety which gave the highest yield of total crop per acre was the least popular with the experimenters, and the variety which gave the lowest yield per acre was the choice variety for general cultivation in the opinion of the experimenters. This is probably due to the fact that the White Cap Yellow Dent is a little earlier than either of the other two varieties. It also showed, according to the reports of the experimenters, a greater number of well-developed ears, while in this respect the Wisconsin No. 7 gave the least. According to the results of experiments conducted at Guelph the Wisconsin No. 7 is somewhat later in maturing than either the Hoopengardner's Very Early Yellow Dent or the early strain of the White Cap Yellow Dent, although in yield of total crop per acre the Hoopengardner's Very Early Yellow Dent surpassed the Wisconsin No. 7 by about one-quarter of a ton of total crop per acre per annum. According to enquiries received from farmers during the past year it appears that the White Cap Yellow Dent is the most extensively grown variety of corn in Ontario at the present time.

Vetches and Grass Peas. In each year since 1899 experiments have been conducted throughout Ontario in the testing of grass peas, common vetches and hairy vetches. These are three leguminous crops which produce fodder rich in digestible nutrients, and which have a beneficial influence on the soil. Grass peas have been grown in Ontario for many years past as a grain crop and also to a certain extent for fodder purposes. The Common Vetches have been used more particularly for mixing with oats for the production of green fodder or of hay than they have for sowing as a crop by themselves. The Hairy Vetches have been recently introduced and have been used considerably as a cover crop by some of our best fruit growers.

In the co-operative experiments over Ontario the greatest yield of fodder per acre of these three leguminous crops was produced by the Hairy Vetches in 1899, 1900, 1901, 1902, 1906, 1907, 1908, 1909 and 1911, so that on the average the Hairy Vetches have given rather higher yields per acre than the grass peas and considerably higher yields than the Common Vetches. The seed of the Hairy Vetches, however, is expensive and unless seed production becomes rather more general in Ontario it is a question whether the Hairy Vetches will be grown as a fodder crop, but will likely be used more or less extensively as a cover crop in orchards.

Millet. The three varieties of millet used in co-operative experiments in 1912 were the Japanese Panicle, the Golden Wonder, and the Hungarian Grass. The Japanese Panicle has been distributed throughout Ontario for co-operative experiments in each of thirteen years and has headed the list in average yield of green crop per acre in each of eight of these years. In yield of green fodder and of hay the Japanese Panicle has given the greatest average production in the co-operative experiments throughout Ontario and in the experiments conducted at the College.

Rape, Kale and Field Cabbage. In the experiments which have been conducted at Guelph with different varieties of rape, kale, and field cabbage, some most interesting results have been obtained. Some of the cabbages have produced average yields of over twenty-five tons per acre for a series of years. These are greater yields than those produced of any of the varieties of corn which have been grown during the same period. Although the Dwarf Essex Rape usually yields well at the College and throughout Ontario, the field cabbage, when used in exactly the same way, has surpassed the Dwarf Essex Rape in productiveness, both at Guelph and in the co-operative experiments.

Clovers. For several years past the seed of Red Clover, Alsike Clover and Mammoth Red Clover has been distributed for co-operative experiments throughout Ontario. The Mammoth Red has usually produced the highest yield in the first cutting, but when the total crop in each season is taken into consideration there has not been very much difference in the amount of hay per acre from the Common Red and the Mammoth Red varieties. It has been found very difficult to present in tabulated form the summary results obtained from co-operative experiments.

Grasses. In each of several years the seed of Tall Oat, Orchard Grass, Meadow Fescue and Timothy has been distributed throughout Ontario for co-operative experiments. The Tall Oat and Orchard Grass have each given an early growth of crop in the spring. The Tall Oat has usually been a high producer of hay, but the seed of this grass is rather expensive and difficult to secure in a pure condition. It is difficult to obtain reliable results in regard to grasses, which can be presented in tabulated form, as they are ready for cutting at different dates and it is extremely difficult to get them cut and cured under uniform conditions.

Alfalfa or Lucerne. Some most interesting and important work is now being carried on both at the College and throughout Ontario in the study of hardy alfalfas for this country. The information obtained from experiments at Guelph is most convincing and shows that there is a very great difference in the different kinds of alfalfa in regard to hardiness. Some varieties will withstand our severest winters very well, while others under exactly similar conditions will become almost completely killed out. We have discovered an alfalfa which has been grown in Ontario for over forty years and which has become very hardy. This is now known as the Ontario Variegated Alfalfa. It was evidently a natural cross between the Common alfalfa and the Yellow Flowered native alfalfa of the Eastern countries. This natural cross which has been grown in Ontario for fully forty years has had

an excellent opportunity for natural selection, the more tender plants being killed by the severe winters and thus leaving the hardy plants to produce the seed. This continuous selection for forty years has evidently had a marked influence in producing a very hardy strain of alfalfa, as we have found in the experimental work at Guelph that the six plots which were sown with Ontario Variegated Alfalfa four years ago have come through the two last severe winters with almost a perfect stand, while the seed of the Common alfalfa, obtained from the Western States, such as Colorado, Nebraska, Kansas, Utah, etc., has been almost entirely winter killed, part of the plants dying in the spring of 1911 and nearly all of the rest in the spring of 1912. The Grimm Alfalfa of Minnesota is also a very hardy strain. This alfalfa has a history somewhat similar to the Ontario Variegated variety. The seed of the Grimm Alfalfa is very expensive, as it is grown in only limited quantities. The price asked for the Grimm Alfalfa seed last year was $100.00 per 100 lbs.

In each of the past two years seed of both the Grimm Alfalfa obtained from Minnesota and the Ontario Variegated alfalfa secured from the Niagara Peninsula was distributed for co-operative work. These alfalfas, as yet, have not been grown for a sufficient length of time to furnish information in regard to the hardiness, but in a short time we expect to receive valuable reports from our various experimenters. The preliminary reports which we have already received are very encouraging in regard to the Ontario Variegated alfalfa, being a very hardy strain and one particularly suited for sowing in northern districts. Unfortunately, owing to the very wet autumn, seed production of the Ontario Variegated alfalfa has been a failure this year. The heavy autumn rains caused a second growth of the crop and the many fields which were left for seed production had to be cut for hay. We hope by another year that there will be a good supply of the Ontario Variegated alfalfa obtainable in this Province. We wish to impress strongly the fact that if Ontario farmers wish to seed down a field of alfalfa to remain for several years it is important to secure seed of a hardy strain, such as the Ontario Variegated or the Grimm alfalfa.

Varieties of Potatoes.

The market value of the potato crop of Ontario has amounted to an average of over ten million dollars annually during the past five year period, according to the reports of the Bureau of Industries for Ontario. In comparison with this we find that the market value of the potato crop of Ontario was over $11,700,000 in 1911, and less than $8,000,000 per annum in the average of the past thirty years. Those counties of Ontario which had the greatest area devoted to potatoes in 1912 were as follows: Simcoe, 8,484 acres; York, 7,115 acres; Middlesex, 6,383 acres; Grey, 5,936 acres; Hastings, 5,840 acres; Carleton, 5,823 acres, and Wellington, 5,137 acres. All of these counties had no less than 5,000 acres of potatoes each. The highest yields in 1912 were produced in Rainy River and Kenora, 269 bushels per acre; Thunder Bay, 238 bushels per acre; Manitoulin, 233 bushels per acre; Algoma, 218 bushels per acre, and Sudbury, 200 bushels per acre; and the lowest yields in 1912 were produced in Halton, 85 bushels per acre; Peel, 92 bushels per acre, and Elgin, 95 bushels per acre. All of the counties in the Province not here mentioned gave an average yield of between 100 and 200 bushels per acre. The northern part of Ontario was decidedly better than the southern part of Ontario in potato production during the last year.

In 1912 an enquiry was made of the various experimenters regarding the most extensively grown varieties of potatoes in the various counties of Ontario. In all

fifty-eight varieties were mentioned one or more times as being the most extensively grown in the different counties. The following gives the names and the order of the varieties which were mentioned the greatest number of times: Rural New Yorker No. 2, Green Mountain, Empire State, White Elephant, Early Rose, Irish Cobbler, Delaware, Early Ohio, Beauty of Hebron, Carman No. 1 and American Wonder. As some reporters mention Carman No. 1, others Carman No. 3, and others simply Carman, it is difficult to classify these varieties. If we take into consideration enquiries which were made in each of the past six years we find that the Rural New Yorker No. 2 has been grown more extensively than any other variety, and this has been followed by the Empire State as the second most extensively grown variety. Although the Green Mountain was mentioned ahead of the Empire State in 1912, these two varieties were almost even, according to reports received.

The following table gives the average results of the co-operative experiments with the varieties of potatoes conducted on 427 farms in Ontario in 1912:

Classes.	Varieties.	Comparative Value.	Per Cent. of Small Tubers.	Mealiness when Cooked.	Bushels of Whole Crop per Acre.
Late Varieties (73 tests).....	Davies' Warrior	100	10	95	186.43
	Empire State	76	13	100	135.28
Medium Varieties (101 tests)..	Burpee's Extra Early.....	100	10	100	170.69
	Rose of the North.....	98	10	95	169.36
Early Varieties (263 tests)....	Irish Cobbler	100	10	100	170.27
	Extra Early Eureka.....	90	10	96	166.89
	Early Andes.....	69	10	85	134.41
	Early Ohio	71	12	90	126.23
	Early Fortune.....	69	14	91	123.46

The Experimental Union distributed two varieties of late, two varieties of medium, and five varieties of early potatoes in the spring of 1912. It has been the object of the Experimental Union to distribute as few varieties as possible from year to year, but at the same time to send out some of the very best kinds according to the results of the hundreds of varieties grown at the College. All varieties distributed this year have been distributed by the Experimental Union in previous years, with the exception of one kind. The aim of the Union is to keep down the number of varieties just as low as possible, but at the same time to give the farmers an opportunity to find out which of the few varieties, which have topped the list of the large number grown at the College, would give the best results for their own particular farms. There are altogether too many different varieties of potatoes grown in Ontario. It is practically impossible for potato buyers to obtain carload lots of uniform potatoes in many neighborhoods of Ontario. This has been a great detriment in enabling the farmers to sell their surplus potatoes at a good price. Merchants find they can obtain uniform lots of potatoes outside of Ontario better than they can in this Province, hence the tendency is to buy the potatoes where they can obtain them of good quality and of a uniform character. The results of the co-operative experiments throughout Ontario, in conjunction with those of the experiments conducted at the O.A.C., should form a good general

guide for the selection of some of the very best varieties of potatoes for extensive growth throughout Ontario. In order to secure large yields of potatoes of good quality which will command high prices it is important that a few of the very best kinds be grown almost exclusively in the different neighborhoods.

The Davies' Warrior, which occupies the highest place in yield per acre in the co-operative experiments throughout Ontario in 1912, has been distributed in each of the past two years. It also occupied highest place in yield per acre in 1911, surpassing the Empire State by an average of 21.4 bushels per acre in 57 experiments. This variety has been under experiment at the College for seven years, and has made a very high record, surpassing all other varieties in yield of potatoes per acre. Not only has it proven to be a large yielder, but it is also a potato of good quality, and has been exceptionally free from rot in the past season. The Davies' Warrior has certainly made a high record, and we believe it will be a potato which will be extensively grown throughout Ontario in a very short time. It is a late variety, and the potatoes are white in color, oval in form, of good table quality, and are quite saleable. The Empire State has been a potato of high yield and of excellent table quality, but it is more susceptible to the attacks of rot than the Davies' Warrior. The Empire State has made a comparatively low yield in 1912 owing to the very unfavorable weather conditions. Of the medium ripening varieties, the Burpee's Extra Early has again made a fine record. It is a potato which yields well, is of good quality, and is popular with the experimenters. Of the early potatoes the Irish Cobbler and the Extra Early Eureka occupy first place. The characteristics of these two varieties are very similar, and the results are comparatively close. In a careful comparison of these two varieties at the College in the past three years it appears that the Extra Early Eureka is a selection of the Irish Cobbler. It is interesting to know that both of these varieties did so well this year, each taking such a lead over the next variety on the list. The Early Andes gave an average of 32 bushels per acre less than the Extra Early Eureka, and 36 bushels per acre less than the Irish Cobbler. The Early Ohio, which is so well known as an early potato over Ontario, although rather better in quality than the Early Andes, is lower in this respect than either the Extra Early Eureka or the Irish Cobbler, and gave a decidedly less yield of potatoes per acre, and was not nearly as popular with the experimenters as either of the two varieties coming at the head of the list of the early potatoes. The Early Fortune made a poor record in 1912 in regard to yield and popularity. It is very interesting to note that the Irish Cobbler and the Extra Early Eureka were exceptionally free from rot in our own experiments at Guelph and the co-operative experiments throughout Ontario. Three of the varieties of potatoes which were freest from rot amongst about two hundred varieties under experiment at Guelph during the past year, and also in the co-operative work throughout Ontario on several hundred farms, were the Davies' Warrior, the Irish Cobbler, and the Extra Early Eureka. We direct special attention to these three varieties, or, as they may be termed, two varieties, for Ontario, either the Irish Cobbler or the Extra Early Eureka for early use, and the Davies' Warrior as a late potato for general cultivation.

Fertilizers with Farm Crops.

In each of twenty years, co-operative experiments have been conducted through the medium of the Experimental Union in testing certain fertilizers with farm crops. At first the experiments were made as simple as possible, but with the

object of giving the experimenters information regarding the fertility of their own farms, and also for furnishing results, which when summarized would give good general information to the farmers, and would form a basis for future work with fertilizers. The first general plan was conducted with oats, fodder corn and mangels. It was revised somewhat for the experiment with winter wheat, and also to a greater extent for potatoes. The only crop used in 1912 in the plan here described was winter wheat. Building on the experience obtained from these co-operative experiments the Union is in a position to do some excellent work with fertilizers, and within the past three years three separate lines of work have been taken up.

For the co-operative experiments the fertilizers and the seeds have been sent from the College to experimenters each year. In the original plan the nitrate of soda and the muriate of potash were applied at the rate of 160 pounds per acre, and the superphosphate at the rate of 320 pounds per acre. A mixture or complete fertilizer was composed of one-third the amount of these fertilizers, and was, therefore, applied at the rate of 213⅓ pounds per acre. Both the Royal Canadian and the potato fertilizer used in each of five years with the potato crop was applied at the rate of 320 pounds each per acre. The nitrate of soda was applied when the plants were about three inches in height, and all the other fertilizers at the time of sowing the seed. Farmyard manure was used in the experiment for the past ten years. The advice to each experimenter was to apply 500 pounds of average cow manure per plot, the application being equal to twenty tons per acre. The cow manure was mixed with the soil to a depth of from four to five inches, and the fertilizers were stirred in the soil to a depth of from one to two inches.

The foregoing description applies to all the co-operative experiments with fertilizers conducted previous to 1910, also those conducted in 1911 with winter wheat and with potatoes, and in 1912 with winter wheat. Another experiment with fertilizers and barley was started in the spring of 1910, another with fertilizers and mangels in 1911, and still another with fertilizers and potatoes in 1912. The table here presented gives the average results of the co-operative experiments with fertilizers as described in the foregoing paragraphs:

Kind of Fertilizers used.	Fertilizer per Acre.		Average Yield per Acre.						
			Oats.	Winter Wheat.	Fodder Corn.		Mangels.	Swede Turnips.	Potatoes.
					Total.	Ears.			
	Exact Weight.	Approximate Cost.	5 yrs. 74 tests.	8 yrs. 22 tests.	8 yrs. 47 tests.	8 yrs. 41 tests.	5 yrs. 41 tests.	5 yrs. 18 tests.	5 yrs. 98 tests.
	Lbs.	$ c.	Bus.	Bus.	Tons.	Tons.	Tons.	Tons.	Bus.
Nothing	.....	.....	38.9	18.9	8.2	2.7	20.6	19.6	129.2
Nitrate of Soda	160	4 80	46.3	22.7	9.4	3.1	26.5	22.5	153.4
Muriate of Potash	160	4 00	43.8	22.3	9.4	3.0	24.6	23.7	160.8
Superphosphate	320	3 92	43.6	22.4	9.0	3.1	24.2	24.7	156.8
Complete Fertilizer	213	4 24	48.7	24.1	9.4	3.2	25.4	25.0	166.8
Potato Fertilizer	320	5 52	.....	.....	.....	.....	.....	.....	167.5
Royal Canadian	320	5 60	.....	.....	.....	.....	.....	.....	164.5
Cow Manure	40,000	6 00	.....	26.3	.....	.....	.....	26.9	174.7

The cost of each fertilizer as given in the table represents very closely the average cost per acre for the fertilizers as used in the co-operative experiments.

The quotations were based on the factory price for quantities of about one ton of each fertilizer. The twenty tons of cow manure would mean about twelve good sized loads per acre, and manure in Guelph has been selling at fifty cents per load, which is probably about the average for the Province. It is exceedingly difficult to place a price on farmyard manure, as in most cases it is not purchased, but is produced on the farm. Each person may place such value on the manure as he deems expedient, and study the results according to his own circumstances. It should be stated that the freight on the fertilizers and the application of both the fertilizers and the manure are not taken into consideration in the foregoing statement, nor yet is there any account made of the influence of the different fertilizers and the manure upon the land after the first season.

If we take into consideration the increases in the yields per acre from the different fertilizers and the average price of the fertilizers per acre, as indicated in the foregoing table, we would find that the increases in the different crops were made most economically by the fertilizers, as follows: Complete fertilizer with oats gave an increase or 9.8 bushels per acre at a cost of about 42 cents per bushel; the complete fertilizer with winter wheat gave an increase of 5.2 bushels per acre at a cost of about 82 cents per bushel; the muriate of potash with corn gave an increase of 1.2 tons per acre at a cost of about $3.33 per ton; the nitrate of soda with mangels gave an increase of 5.9 tons of roots per acre at a cost of about 81.4 cents per ton, or 2.5 cents per bushel; the complete fertilizer with Swede turnips gave an increase of 5.4 tons per acre at a cost of 78.5 cents per ton, or 2.4 cents per bushel, and the complete fertilizer with potatoes gave an increase of 39 bushels per acre at a cost of 10.9 cents per bushel. Each experimenter was asked to conduct his fertilizer test on the average soil of his farm. The results here presented are, therefore, for the average soils of Ontario. On some farms the fertilizers paid much better than they did on others. Every farmer who uses fertilizers should know as much as possible in regard to the requirements of his own particular farm. The results here presented speak in a very general way regarding the use of these fertilizers under the varying conditions of farms of the Province.

Ten Plot Experiment with Fertilizers and Barley.

In 1910 arrangements were made for conducting an experiment with fertilizers and barley throughout Ontario. The experiment consisted of ten plots, seven of which received commercial fertilizers, one lime, one cow manure, and one was left unfertilized. For the seven plots which received commercial fertilizers, nitrate of soda, superphosphate and muriate of potash were used singly and in combination of two and three together. The number of pounds per acre of each fertilizer used was 100 for both the nitrate of soda and the muriate of potash and 200 for the superphosphate, whether these were sown separately or in combination. The freshly slaked lime which was used in 1910, and the hydrated lime used in 1911 and in 1912 was applied at the rate of 1,400 pounds per acre, and the cow manure at the rate of twenty tons per acre. As in the case of the other fertilizer experiments, the nitrate of soda in every instance was applied when the plants were about three inches in height, and all the others were applied at the time of seeding. All the other applications for the fertilizer experiments with barley were the same as those for the fertilizer experiments previously reported. The average of the five reports of successfully conducted experiments for 1912, and

of the twenty-two reports of the experiments conducted in the past three years are here presented:

—	Individual Fertilizer per Acre.	Total Fertilizer per Acre.		Yield per Acre.			
				Straw (tons).		Grain (Bus.)	
	Pounds.	Pounds.	Cost $	1912	Average 3 yrs.	1912	Average 3 yrs.
1. Nothing	.....	.....	.....	1.57	1.24	26.67	25.74
2. Nitrate of Soda	100	100	3 00	1.62	1.33	29.33	29.24
3. Muriate of Potash	100	100	2 50	1.74	1.44	33.33	30.92
4. Superphosphate	200	200	2 45	1.79	1.47	33.00	31.45
5. Nitrate of Soda	100	200	5 50	1.92	1.47	33.33	32.57
Muriate of Potash	100						
6. Nitrate of Soda	100	300	5 45	1.73	1.42	38.27	33.84
Superphosphate	200						
7. Muriate of Potash	100	300	4 95	1.80	1.49	36.85	34.08
Superphosphate	200						
8. Nitrate of Soda	100	400	7 95	1.81	1.49	40.67	36.09
Muriate of Potash	100						
Superphosphate	200						
9. Lime	1,400	1,400	4 60	1.66	1.35	35.33	29.76
10. Cow Manure	40,000	40,000	6 00	1.86	1.57	41.00	36.52

The results show that the fertilizers and manure surpassed the unfertilized land in yield of barley from 4 bushels to 10.8 bushels per acre in the average for the three years. The highest yield per acre was produced by the cow manure, and the second highest by the complete fertilizer. In 1912 the results ran in much the same order as in the average for the three years. According to the increases in the yield of barley per acre and the prices of the fertilizers given in the table, it appears that the most economical results were obtained by the application of 200 pounds of superphosphate per acre, as this application increased the yield of barley 5.7 bushels per acre at a cost of about $2.45, or an average cost of about 43 cents per bushel. The complete fertilizer increased the yield of barley on an average of 10.35 bushels per acre, but this was done at a cost of 77 cents per bushel. The lowest yield of barley per acre in 1912 was 14 bushels, which was produced on sandy loam which was left unfertilized, and the highest yield of barley per acre was 28½ bushels, which was produced on gravelly soil on which muriate of potash and superphosphate were applied.

Application of Nitrate of Soda and Common Salt with Mangels.

For five years in succession co-operative experiments were conducted throughout Ontario in testing different fertilizers with mangels. As a result of this experiment it was found that an application of 160 pounds of nitrate of soda per acre applied to the land when the mangels were about three inches in height increased the yield of roots per acre six tons, according to the average results of the 41 separate tests conducted within the five year period. In the spring of 1911 another experiment was started with fertilizers and mangels. For this experiment nitrate of soda was applied to the mangels at the rate of 100, 160 and 200 pounds per acre at the time of sowing the seed, and also on separate plots when the mangel plants were about three inches in height. In comparison with these six

plots with nitrate of soda, common salt was applied at the rate of 200 and 400 pounds per acre at the time of sowing the mangel seed. Two plots were left unfertilized in each experiment. In 1911 only two complete reports were received, and in 1912 four complete reports were obtained. In averaging results from the duplicate plots on four Ontario farms in 1912 we find that the average of the ten plots in tons of mangels per acre from the nitrate of soda were as follows: 38.5 tons from 100 pounds, 40.9 tons from 160 pounds, and 42.4 tons from 200 pounds. Under similar conditions unfertilized land gave 35.9 tons. It will therefore be seen that the 160 pounds of nitrate of soda increased the yield of mangels five tons per acre, while the increase in the mangel crop from the 160 pounds of nitrate of soda for the five year period in connection with the other experiment was 5.9 tons per acre. According to the results obtained in 1912 the nitrate of soda which was applied at the time that the seed was sown gave an average yield of roots per acre from the twelve plots in the four experiments of about one-half ton per acre more than the yield obtained from the corresponding twelve plots which were sown with the nitrate of soda when the plants were about three inches in height. The 200 pounds of nitrate of soda gave nearly two tons of roots per acre more than the 200 pounds of common salt in the average of the four experiments conducted in 1912. This experiment in its entirety will likely be repeated in a co-operative way throughout Ontario for several years, and as time passes the results through their accumulation will increase in value, and we hope to obtain in this way some very valuable information.

Six-Plot Experiment with Fertilizers and Potatoes.

As a result of experiments conducted at the Ontario Agricultural College in each of five years it was found that the Royal Canadian and potato fertilizer gave the highest yield of potatoes per acre of the different fertilizers used in the five year experiment. In another experiment, extending over a period of five years, in which several fertilizers were used, the highest yield per acre was obtained from a mixed fertilizer similar to the one used in our co-operative experiments, and which was composed of nitrate of soda, muriate of potash and superphosphate in the proportion by weight of 1, 1 and 2, and which was applied at the rate of 213 pounds per acre. This was followed by the Royal Canadian and the potato fertilizer, each of which was applied at the rate of 320 pounds per acre. Based on these and other results, a co-operative experiment was conducted in each of five years previous to 1912, in which six different fertilizers were compared with each other, with farmyard manure, and with no fertilizer with potatoes. The average results of this experiment conducted within the five-year period on 98 farms of Ontario were reported in 1911. The average results of the 98 experiments showed the yield of potatoes per acre to be as follows: Unfertilized land, 129.2 bushels; 160 pounds of nitrate of soda, 153.4 bushels; 160 pounds of muriate of potash, 160.8 bushels; 320 pounds of superphosphate, 156.8 bushels; 213 pounds of the complete fertilizer previously described, 166.8 bushels; 320 pounds potato fertilizer, 167.5 bushels; 320 pounds of Royal Canadian fertilizer, 164.5 bushels, and 20 tons of cow manure, 174.7 bushels. According to the prices given for the manure and the fertilizers in the report for 1911, the increased yield of potatoes was produced at a cost per bushel for the complete fertilizer of 11.3 cents; muriate of potash, 12.7 cents; cow manure, 13.2 cents; superphosphate, 14.2 cents; potato fertilizer, 14.4 cents; Royal Canadian fertilizer, 15.9 cents, and nitrate of soda, 19.8 cents.

Taking the results of past experiments into consideration, it was thought wise to start a co-operative experiment in testing different quantities of fertilizers per acre in comparison with each other, with farmyard manure alone, farmyard manure and fertilizer, and with unfertilized land. We therefore placed on our list an experiment with commercial fertilizers, cow manure, and no fertilizer with potatoes, and we received 120 applications from farmers for the material for this experiment. We divided this number into four groups of thirty each, and used the Royal Canadian fertilizer for one group, the potato fertilizer for another, a fertilizer composed of nitrate of soda, muriate of potash and superphosphate in the proportion by weight of 7, 9 and 16 for another, and a fertilizer composed of nitrate of soda, muriate of potash and superphosphate in the proportion of 1, 1 and 2 for the fourth group. Each of the first three fertilizers were applied alone at the rate of 320, 640 and 960 pounds per acre, and 320 pounds in combination with ten tons of cow manure per acre. In comparison with these another plot received cow manure at the rate of twenty tons per acre, and one plot was left unfertilized. For No. 4 group the fertilizer was used in the same proportion, with the exception that the minimum amount was 213 instead of 320 pounds per acre. Owing to the unusual weather conditions of the past season the potato rot was very prevalent in Ontario, and many of the results of the fertilizer experiments obtained cannot be used on that account. We have, however, obtained nineteen good reports of successfully conducted experiments with fertilizers and potatoes in which the rot did not prove troublesome, and which represent fairly well the four different kinds of fertilizers distributed. We think it unwise to present the results of this experiment in detail for the one year, but give the following as the average yield of potatoes per acre from the fertilizers belonging to the first three groups: No fertilizer, 107.6 bushels; 320 pounds of fertilizer per acre, 140.1 bushels; 640 pounds of fertilizer per acre, 149 bushels; 960 pounds of fertilizer per acre, 170.5 bushels; 320 pounds of fertilizer in combination with ten tons of cow manure per acre, 158.8 bushels, and twenty tons of cow manure per acre, 166.3 bushels. It will be seen that an application of 320 pounds of fertilizer per acre increased the crop 32.5 bushels per acre, while 960 pounds of fertilizer increased the crop 62.9 bushels per acre, or in other words 320 pounds exerted more than one-half the influence of 960 pounds of fertilizer per acre. From a study of the individual groups the most economical returns in 1912 were obtained from 320 pounds of the Royal Canadian fertilizer per acre, and from 213 pounds of the fertilizer composed of nitrate of soda, muriate of potash and superphosphate in a proportion by weight of 1. 1 and 2. It is the intention to repeat this experiment in exactly the same way for several years, and in that way some most valuable information should be obtained.

A MEMBER: Was the lime you used burnt lime?

PROF. ZAVITZ: In these experiments the first year we used slaked lime, and in each of the last two years hydrated lime.

A MEMBER: How were the fertilizers applied?

PROF ZAVITZ: All, with the exception of nitrate of soda, were applied at the time of sowing or planting the crops. In most of the experiments the nitrate of soda was applied when the plants were about two or three inches in height, except in two or three of the more recent experiments, in which the nitrate of soda was also applied at the time of sowing the crop. In the experiments which we conducted this past year the nitrate of soda, which was applied at the time that the

mangels were sown, gave rather better results than that which was sown when the plants were two or three inches in height.

A MEMBER: Did you sow the fertilizers broadcast?

PROF. ZAVITZ: Yes; the fertilizers were sown broadcast in each of the experiments here reported.

A MEMBER: I would like to say just a few words about the fertilizer experiments. I have no criticism to offer in regard to the way in which the experiments are conducted. I think there might be some improvement made in the way in which the results of the fertilizer experiments are presented. They are not exactly in a form in which we would like to get them, as, for instance, the averages would show that nitrate of soda had been one of the best fertilizers to use on mangels. That does not tally at all with the results that I have obtained. I tried the experiment sent out by the Union last year, and the nitrate of soda only gave me an increase of two tons, whereas the application of about one barrel of salt to the acre gave me an increase of about six tons. In no case can I get a paying return from the use of nitrate of soda on my land. I think if these returns could be grouped, and we could be given a number of cases in which each particular fertilizer gave the best results, with some clue as to the kind of soil used, and perhaps the district from which the results came, I think they would be of greater value. I notice that with potatoes the complete fertilizer has proven on a whole the most profitable. I have obtained the best results from sulphate of potash. I might say that I have always used a little barnyard manure on the ground as well as the fertilizer. That may perhaps modify the results to some extent. I do think that if the results could be presented in greater detail that they might be more serviceable to us as farmers.

PROF. ZAVITZ: I agree with Mr. Hutchinson exactly. One of the great objects of the co-operative experiments with fertilizers is to enable the farmers themselves to study their own soil and to know which fertilizers give the best results with the particular crops in which they are most interested. A detailed study of these results is interesting and suggestive. We hope in time to bring out the detailed results, and also to group the results according to different soils, etc. In some of our reports we have presented the detailed results, as, for instance, those for fertilizers and potatoes. In these reports the names of the experimenters, counties in which they reside, the character of the soil, and the results of the fertilizers are enumerated. Unless many of the details are understood there is a danger of drawing too definite conclusions from the individual tests. The average results give information of a general character which are worthy of careful study. They show how the individual fertilizers behave on the average soils and in various seasons. We are getting certain general averages which are of considerable value, and individual farmers are gleaning information from their own experiments which is of great value to them.

In regard to what Mr. Hutchinson states in reference to the use of salt and of nitrate of soda with the mangel crop, I would say that if I were a farmer I would feel like putting greater stress on the average results from the use of nitrate of soda and of salt with the mangel crop throughout the Province of Ontario than from one individual experiment. I believe that if a man would follow more closely the average results he would have a safer basis on which to work than if he would simply take the results of Mr. Hutchinson's, which, he states, are contrary to the accumulated results of those who conducted this experiment. In the average of the

co-operative experiments nitrate of soda gave an average increase of about two tons of mangels per acre more than the crop obtained from the use of salt.

A MEMBER: If the farmers are educated to decide what fertilizer they should use by the need of their soil and by the amount of previous fertilization it has had there would not be so many poor results recorded from the use of commercial fertilizers. I would think that in the reports of these experiments it would be a good plan to state the results more in detail and to give information in regard to the nature of the soil. This would be given in addition to the average results.

A MEMBER: The season seems to have a very great influence on the results from the application of common salt. This year the salt did not give nearly as good results as it did a year ago. I think perhaps in a dry season we get rather better results from commercial fertilizers than we do in a wet season. I had a large series of plots and I could see every plot in detail, and the results were very interesting. I had no means of ascertaining the amount of increase from the use of the different fertilizers. I have noticed quite marked results in grain crops from some of the fertilizers used with potatoes in the preceding year. What I used were mostly mixed fertilizers, and those containing phosphate seemed to give particularly good results with the barley in the second year.

PROF. ZAVITZ: We have done but little in an experimental way with different brands of fertilizers which are sold on the market. In order to test all the different brands of fertilizers we would undertake a task which is beyond our present circumstances to carry out. We have been dealing largely with separate fertilizers and with definite combinations which we have prepared ourselves so as to work along definite lines as nearly as possible. We are obtaining many most interesting results, and it may be possible for us to bring out the detailed reports of all the fertilizer experiments in the near future. In addition to the detailed results, summaries of the experiments conducted in different localities and on different soils might be presented.

MR. HUTCHINSON: I think that is a splendid idea. The average farmer cannot possibly make many of these experiments in detail for himself, and the detailed information of the experiments conducted in various localities and on different soils would furnish information which would enable a farmer to choose the fertilizer which he could use on his own land, and would often prevent disappointment.

PROF. ZAVITZ: I wish to say that it is exceedingly difficult for any one farmer to accept the results of fertilizer experiments from any other farmer as a definite guide. These results, however, form valuable suggestions and helps. Those men, however, who conduct experiments upon their own farms, as so many of the Experimental Union members are now doing, are in a position to receive better information than they could from the results of other individual farmers or from the average results of a large number of experimenters.

PROF. HARCOURT: After all, it is an individual question. Every soil and every crop has its own peculiarities, and while we could talk and discuss individual results as of some guide to us as to what we would do on another soil, no man should take the results from any other man's experiments and say that these will comply directly to his own soil. Neither can we take any generalities as definite guides, but every man has got to experiment for himself or else take the chances on the losses that come from trying to buy fertilizers by following somebody else's experience.

RESULTS OF CO-OPERATIVE EXPERIMENTS WITH FERTILIZERS ON VEGETABLES AND FRUITS.

Prof. R. Harcourt, O. A. College, Guelph.

Your committee have to report that they have continued the experiments outlined to the meeting last year. In addition, we have also added a number of similar experiments. These experiments are all five-plot tests arranged as follows:

Plot No.1.—Check Plot.

2.—Nitrogen, Potash, Phosphoric acid.

3.—Nitrogen, Potash.

4.—Nitrogen, Phosphoric acid.

5.—Potash, Phosphoric acid.

Most of the plots were a quarter acre in size, consequently there would be one and a quarter acres in most of these experiments. A few of the plots were reduced to one-fifth acre. The directions were that the fertilizers were to be applied in addition to the farmyard manure, as we consider that the true place of a fertilizer is to supplement rather than to take the place of farmyard manure. The experiments were arranged so as to bring out whether fertilizers can be applied with a profit to the various crops under the prevailing conditions. This year we have conducted fertilizer experiments with fruits as follows:

4 Apple orchards: 3 reports received.
3 Peach orchards: 1 report received.
2 Experiments with Raspberries: No reports received.
2 Experiments with Strawberries: No reports received.
1 Experiment with Gooseberries: One report received.

The apple orchards are all in bearing, and the fertilizers were applied this year for the second time, but this is the first year that we have got a report on the yields, and as there are so many circumstances affecting the yield of an orchard we do not think that it is well to give the results of one year, and as the soils are quite different in their nature it would be useless to average the results.

Only one of the peach orchards is yet in bearing, and this is the first year it has given any fruit.

The raspberry and strawberry experiments were started this year with the planting of plants, and, naturally, no results can be got until next year.

The experiment in the apple orchard of the Forestry Farm, which was outlined in last year's report, is continued.

In the above experiments the orchard plots were one-quarter acre and the smaller fruits were one-eighth of an acre in size.

Vegetables.—The following experiments were carried out with vegetables:

Tomatoes	3 experiments, 2 reports.
Potatoes	12 experiments, 11 reports.
Corn	15 experiments, 9 reports.
Onions	1 experiment, no report.
Mangels	4 experiments, 4 reports.
Turnips	5 experiments, 4 reports.

The results obtained from these experiments were naturally very contradictory, in that they were conducted on a number of different types of soil. Because of this variation in soil, we feel that it would not be wise to average the results, and, consequently, we will not make any detailed report this year. I may say, however, that the fertilizers gave very much increased yields, and that in many cases there was a direct indication that the yield was influenced by one constituent more than another.

Our experiment in the garden here at the College was continued. This year there was quite a noticeable difference in the appearance of the various plots. Some yields were secured, but these results we will also hold until we have a greater accumulation of data.

IMPORTANT RESULTS FROM THE USE OF LEGUME BACTERIA ON ALFALFA AND OTHER LEGUMES EACH YEAR SINCE 1905.

Prof. S. F. Edwards, O.A.C., Guelph.

The work in seed inoculation was begun in 1905 by Harrison and Barlow. Briefly, the method consists in applying to the seed before it is sown artificially grown cultures of bacteria originally secured from nodules on the roots of the same species of plant which is to be seeded.

Each year blanks have been sent to recipients of cultures asking for a report as to their success with the inoculation.

The work was carried on in 1912 in much the same manner as in previous years. A total of 4,722 cultures, each sufficient for one bushel of seed, were sent out, of which 3,898 were for alfalfa, 570 for red clover, and the remaining 254 were divided among alsike clover, white clover, peas, beans, vetches and sweet peas. The greater number of the cultures were sent to farmers in Ontario, although a comparatively large number of alfalfa (132 and 162, respectively) were sent to Alberta and British Columbia. The total number of farmers to whom cultures were sent was 2,602, of whom 2,102 received cultures for alfalfa.

A summary of this work for each season thus far is given in the accompanying table, which shows that for the eight seasons the average percentage of favorable results is 62.2 per cent.

Summary of Results in Seed Inoculation, 1905-1912.

Year.	Total Cultures Sent.	Total Reports Received.	Inoculation Beneficial.	Inoculation not Beneficial.	*Others.	Per Cent. Favorable.
1905	246	134	91	40	3	69.4
1906	375	144	72	48	24	60.0
1907	372	187	67	57	63	54.0
1908	2,113	699	397	237	65	62.6
1909	2,017	494	211	161	122	56.7
1910	3,375	771	344	179	248	65.7
1911	4,941	1,307	453	371	483	55.0
1912	4,772	885	412	141	332	74.0

* In this column are included reports from farmers who sowed no uninoculated seed, or in which long continued drouth, excessive moisture, or some other condition injured or destroyed the seeding. These are not figured in the percentage column.

One interesting point with regard to the sending of the cultures is the increase in the number of cultures sent to the different farmers. The first year I do not think there was a single one who asked for more than one culture. It was merely in the experimental stage at that time, and the interest has gradually increased until in some cases we have sent 30 or 40, and in one case this year we have sent 60 cultures to one farmer. One culture is enough for one bushel, but the average number of cultures sent to each individual has increased very markedly since the work first started out.

RESULTS OF CO-OPERATIVE EXPERIMENTS IN APICULTURE.

Morley Pettit, O.A.C., Guelph.

I come before you this afternoon representing what is not considered to be one of the ordinary branches of farming, and yet one which appears to me to be capable of more development than almost any other branch of agriculture. In fact, I have been accused by some bee-keepers, who it seems to me are acting the "dog in the manger," a little bit, of booming bee-keeping too much in Ontario, and making too many new bee-keepers. I do not consider that that is necessary, when I say we have on our list of bee-keepers upwards of 8,000 names in Ontario, and it is not so much a question of making new ones as rousing the interest of those who are already more or less engaged in the business. And we have the satisfaction of noticing that those who are taking an interest in our work are those who have bees, because they know something of the results that are to be obtained and see the possibility of adding more.

We started the short course last year with about fourteen in the class. We started this year's this morning with about thirty, and possibly more coming in.

The response to the application blanks sent out for experiments in apiculture was very encouraging. We got each year between 350 and 400 applications for the experiments.

For 1912 we sent out three experiments and two special experiments on races of bees:

1. On the Prevention of Natural Swarming by holding the colony together.
2. On the Prevention of Natural Swarming in Comb Honey Production.
3. On the Prevention of Natural Swarming in Extracted Honey Production by manipulation of Hives instead of Combs.

These three experiments were all very well received. We had for experiment No. 1 220 applications, and we received 31 reports.

For experiments in No. 2 we had 68 applications, and received six reports.

For experiment No. 3 we had 93 applications, and received twelve reports.

Now, this does not look like a very large percentage; but I think if you will enquire into the work of some of the other branches of the Union you will find we are getting a good percentage of reports from those who apply for the experiment, particularly as our work involves a certain method of management of the bees. It is not a case where you can take and survey out a couple of plots and plant seed of one kind in one plot and seed of another kind in another plot and then watch them grow. But it is a matter of management of the colonies from week to week all during the summer, and a great many we find start in well and fail to finish the race for one reason or another. One reason for this, this year, was the

peculiarity of the season. We had the peculiar condition this year of a total failure of the crop in Eastern Ontario and a very good crop in Southwestern Ontario. Reports seem to show that the crops gradually drop off from nothing in the east to a really good crop down in the southwestern part of Ontario. The result is that our eastern experimenters have not good reports, and we are getting very good reports from those in the southwest.

Just to show that bee-keeping is not a thing with which there is great mystery and unsurmountable difficulties, I want to give you an instance of one of our students. In 1910 one of our students, who took the course in apiculture, became interested in the subject. He had a few bees at home, and came to me and asked for work the following summer. A position was secured for him with a bee-keeper having about 700 colonies. He spent the summer there and had a lot of good experience, and got a lot of practical information. He came to us in April, 1912, and went on inspection work, and he also had the management of the apiary at Vineland. He had practically the whole responsibility. I was down there two or three times during the summer, and he came to me and received advice on the management of those colonies; but aside from the little advice he got he did the work and looked after them. Those 30 colonies increased to 60 under his management, and 2,500 pounds of honey were extracted, which sold for a little less than $300; the 30 extra colonies we will say at $3 per colony, and that is not a high estimate, will be worth upwards of $100. Thus the returns from that apiary is estimated to be between $350 and $400 for the season, under the management of a student who had received the apiary lectures at the College, had one year's experience with bees, and then took charge of keeping those bees.

Any man is able to start out keeping bees for himself, and he is certain to make as much success at that as he would at other things.

Now, coming back to the results of the experiments. On experiment No. 1 we had 31 reports from 18 different counties of Ontario. These 31 experimenters reported 830 colonies in the spring, 1,109 colonies in the fall, being a spring average of 27 colonies each, and a fall average of 36 colonies each, an average increase then of 33.6 per cent. The total honey crop of the 31 experimenters was 63,230 pounds of honey, an average of 36.1 pounds per colony, which is not a bad average considering what this would be worth.

There were six reports on experiment No. 2 from five different counties. On experiment No. 3 twelve reports were received from five different counties.

To sum up, those 49 experimenters having 1,506 colonies spring count, had 2,089 colonies of bees fall count, and estimating their capital investment at $10 per colony, which you will agree with me is rather a high estimate, this represents for the 49 experimenters a capital investment of $20,000, or about as much as two average farmers on 100 acre farms would have invested. I think I am safe in saying that the average farmer on a 100 acre farm has $10,000 invested, that is, counting his equipment and live stock and everything. Now, the income from this $20,000 investment is:—

1st. 574 new colonies at a price of $3 each, which is a low price, even for fall price. This figures out to.....	$1,722 00
They also had 97,042 pounds of honey, which would be worth at least	10,000 00
Making the returns from the $20,000 investment	$11,722 00

or a percentage return on capital invested of 58 per cent. I am not taking into account their labor or their experience, neither is the farmer taking into account his labor or his experience when he gets perhaps a 10 per cent. return on his capital invested. Can you take 50 farmers, or 49, scattered all over Ontario, and average up their returns and get half of 58 per cent. return in their capital investment?

I just want to show you a few views in connection with our work, and I have some charts showing the returns.

One of the important things in the prevention of swarming is to clip the wings of the queen to prevent her flying when the swarm comes.

A MEMBER: Is it a better way to hold her?

MR. PETTIT: Well, I prefer No. 1 than No. 2 myself, because you don't touch the body of the queen so much with the fingers as in No. 3, where the fingers come in contact with the thorax.

A MEMBER: Do you think there are some queens clipped without catching them at all now?

MR. PETTIT: Some with a steady nerve are now cutting them without catching them, but I prefer the old way.

A MEMBER: Do you just clip one wing?

MR. PETTIT: It is a matter of convenience. It is a little better to clip only one.

It is of great assistance in controlling swarming to have shade over the hives.

(A number of slides were thrown on the screen, illustrating the subject, and they were explained by Mr. Pettit.)

The result of failures from inexperienced manipulation of the combs is that the beekeeper either keeps at it until he does it well, or he gets discouraged and says it is better to let them alone. The general result is that proper manipulation brings increased production.

So as a result of this work we are able in some cases to teach him an improved method; in other cases we find that the man's method is just as good as any which we could suggest.

CO-OPERATIVE FORESTRY IN ONTARIO.

PROF. E. J. ZAVITZ, FORESTRY DEPARTMENT, O. A. C., GUELPH.

Owing to the time element in growing forest trees an annual report on co-operative forestry must be somewhat of a repetition.

This last season about 375,000 plants were sent out into thirty-five counties. Trees have gone into every county in Southern Ontario, and the following list shows the distribution of trees to the various counties:

Addington County	1,000 trees	Grey County	9,620 "
Algoma County	4,062 "	Haldimand County	15,550 "
Brant County	45,100 "	Haliburton County	8,000 "
Bruce County	20.608 "	Halton County	575 "
Dufferin County	1,570 "	Huron County	37,765 "
Durham County	33.975 "	Kent County	23,925 "
Dundas County	16,075 "	Lambton County	29,434 "
Elgin County	9,475 "	Lanark County	2,633 "
Essex County	15,630 "	Leeds County	6,500 "
Frontenac County	1,150 "	Lennox County	300 "
Grenville County	8,345 "	Lincoln County	19,577 "
Glengarry County	1,200 "	Middlesex County	50,165 "

Manitoulin County	6,500	"	Simcoe County	11,280	"
Nipissing County	775	"	Stormont County	14,300	"
Norfolk County	438,050	"	Victoria County	8,600	"
Northumberland County	2,100	"	Waterloo County	22,730	"
Ontario County	49,650	"	Welland County	56,005	"
Oxford County	15,875	"	Wellington County	295,537	"
Parry Sound County	2,075	"	Wentworth County	5,200	"
Peel County	27,150	"	York County	54,720	"
Perth County	43,195	"	Miscellaneous:—(Experimental Stations and Sister Institutions in other Provinces)	40,778	"
Peterboro' County	22,810	"			
Prince Edward County ..	395	"			
Rainy River County	30	"			
Renfrew County	550	"			

From the above list it will be seen that our distribution has reached about one and a half million plants.

The bulk of the planting done under this system of distribution is upon waste types of soil, and of this a large percentage is upon light sandy formations. We find that the Scotch Pine is giving the best results and in some of the older plantations (four and five years old) where this tree was used upon pure sand formations, we have 80 to 90 per cent. of healthy growing stock still left with the trees averaging from 4 to 6 feet in height.

In a number of places experimental plantations were made upon drifting sand to prevent the encroachment of the sand upon the township roads. Some of these plantations have been very interesting, as the local people thought it a waste of time to plant trees upon such poor soils. In nearly every case where this kind of planting has been done with Scotch Pine it has been successful and the location of the planting along the highway has made the experiment especially valuable.

The Forest Station in Norfolk, where our nurseries are located, now contains 1,500 acres, and we hope will be consolidated by further purchases to contain at least 2,000 acres. At this Station we now have 100 acres of experimental planting and the nurseries contain about one and one-half million plants for future planting.

A MEMBER: Do you send out the seed or a small plant?

PROF. E. J. ZAVITZ: The bulk of our distribution is with evergreen plants, which are difficult to grow from the seed. It requires special attention in nursery work, so we send out the plant altogether in this distribution. I may say that we have sent out to some places Black Walnut and some nut-bearing trees. Sometimes people prefer the nut to plant in finer locations, and in that case we send the seed, but not in every case.

A MEMBER: If we were planting timber for future generations, many of us have timber lots, possibly the majority of them being covered with maple and birch, as they grow the most readily on our land—would it pay to plant White Pine, would it be the best thing for our timber where it is a little spare, or, would it pay better to plant the Scotch Pine, looking at it from the timber standpoint? I look at it this way, possibly future generations will want pine, as it seems to be getting scarce, and if we planted it—my experience is drawn into this from watching it for a period of thirty years—a pine attains quite a size in thirty years; would it pay to plant them all through our timber where it is becoming a little scant? We find no difficulty in getting maple, but pine seems to be hard to get through our lots. I have noticed it all over. Of course, pine usually grows on our lightest land, and it grows much slower on our heavy land. The reason I say that is, that on our ridge in the county of York, which goes through Ontario, pine grows faster there than any place I know of. The question is, would it pay to plant pine in our wood lots where the timber is getting thin? Would it be successful?

PROF. E. J. ZAVITZ: The question is rather an interesting one, and in my reference to Scotch Pine I was referring to Scotch Pine on sand formation, on which we find it impossible to get our native White Pine to start well. In the ordinary wood lot that has open spots, the soil is usually of a very good nature and an ordinary wood lot of that kind would have good soil to plant in. I might say that we have quite a number of cases where planting has been done of that nature, that is, filling in with White Pine, and the White Pine is the tree that we are using. I might add that it is a difficult matter to foretell what is going to happen when you plant Pine in conditions of any kind, because Sugar Maple especially is a very, very thick shade tree, and that prevents growth, but as a rule where you can get growth of grass in a wood lot you can depend on it standing out that amount of shade. That is, it will grow where grass will. As to whether it will pay, I would not want to say. As a straight financial investment, if you consider everything, I would not want to say that it would pay. But the resident owner, the man living upon the farm with the wood lot as a permanent investment, might better keep it in good condition than in a half sort of way.

A MEMBER: Would it not be possible to keep wood lots covered with quicker growing trees than White Pine? And if White Pine are to be grown, would it not pay better to plant them in bare places where we can spare more ground?

PROF. E. J. ZAVITZ: The quicker growing trees, for instance the Scotch Pine, and some of our faster growing trees, such as the White Ash, all demand a great deal of light. There are a number of those trees which are very difficult to get to grow beneath the shade of other trees. The White Pine will stand a good deal of shade. The White Pine and Norway Spruce will stand probably more shade than any other evergreens we have. I might say that in interplanting in a wood lot it is advisable to plant evergreens.

A MEMBER: I should like to ask if the speaker thinks it would pay the average farmer to set out a Walnut grove from the paying standpoint?

PROF. ZAVITZ: The Black Walnut?

A MEMBER: Well, Walnuts for table use.

PROF. ZAVITZ: I would not want to discourage the planting of Black Walnut on a small scale. I think it is a very desirable thing to do. I think it is worth while having the Black Walnut about the farm, not only for the question of future wood, but more largely for the things which are eatable. But so far as wood production from the Black Walnut is concerned I would not think that, as a financial investment alone, it would be advisable to plant it on a large scale. We have a Black Walnut plantation up in the experimental field. That plantation is about thirty years old, and at the time it was planted it was expected that it was going to "lift the mortgage on the farm." But, to-day, the best of those trees are running around six inches in diameter. Now, that soil, of course, was not ideal for Black Walnut. A great deal of our soil is not suitable for Black Walnut; and even on ideal soils in Ontario, so far as wood production is concerned, it is a very poor tree. There are always other considerations in planting trees—the small cost of planting, etc.

A MEMBER: What would you say is ideal soil for Black Walnut?

PROF. ZAVITZ: I would say a deep, sandy loam. We find it on limestone ridges in Southern Ontario. Some of the finest that grow in Ontario grow on sand formations, but the natural soil is a loam.

REPORT OF THE EXTENSION WORK WITH THE SCHOOLS AS CARRIED OUT THROUGH THE SCHOOLS' DIVISION.

Prof. S. B. McCready, O. A. C., Guelph,

Director of Elementary Agricultural Education.

This branch of the Union was organized in 1909 and has now completed its fourth year of operation. Its aim is to adapt the work of the Union to the schools of the Province and to induce teachers and boards of trustees to take up some phase of it as a reasonable foundation on which to base instruction in agriculture.

The work for the year has been along the same lines as those laid down four years ago. Distributions of planting material have been made to schools with instruction for carrying out the practical work in the school or home garden, and also instruction for using the children's experiences for lessons in the class room. The following have been sent out free:

1. Collection of Forest Tree Seedlings from the Forest Nursery in Norfolk Co.
2. Packets of O.A.C. No. 21 Barley for an experiment on the best time to sow;
3. Packets of Ontario Variegated Alfalfa for demonstration and experimental plots;
4. Packets of Red Wetherfield and Yellow Globe Danver Onion Seed for a variety test;
5. Lettuce seed for experiment in Lettuce Growing;
6. Packets of Flax, Sorghum and some of the more unusual crops for demonstration plots;

In addition to the free distribution, much material was sent out, for which a charge was made:

1. Flower and Vegetable seeds for children's garden work either at home or in the school garden;
2. Tulip bulbs for fall planting;
3. Vines for decorating the school or covering out-buildings;
4. Shrubbery for planting on the school grounds.

In all about two hundred and fifty schools shared in the distribution. These are located in all parts of the Province, but most of them are in the counties of the Western Peninsula. It is gratifying to note that some schools in the newer parts of the Province joined in the work.

From the many reports received from teachers on their work the evidence accumulates that it is through work of this nature that we will arouse new interests in the country schools and reach far in solving some of the problems of rural life. A summary of these reports will be printed in Circular 13 issued by the Department of Education to every school in the Province, as well as to all persons interested in the question of teaching agriculture in the schools.

As Director of Elementary Agricultural Education other lines of work have been carried out in close connection with this work of the Schools' Division. A series of charts containing lessons in Agriculture was commenced. Two of these were distributed to the schools in the spring. No. 1 dealt with Alfalfa and No. 2 with the Best Time to Sow Spring Grains. Through these any teacher in Ontario can take up valuable work in her school on Agriculture; and if seed is procured and the work made practical great good may result, not only for Agriculture, but for the education of the child.

This represents the Alfalfa Chart. A number of teachers report that they have been able to arouse a good deal of interest in the subject through its use.

THE DEPARTMENT OF EDUCATION

ONTARIO

LESSONS IN AGRICULTURE

No. 1 SCHOOL CHART, 13D—1912

[THE PROPERTY OF THE SCHOOL]

ALFALFA or LUCERNE

This plant is one of the most valuable ever brought into cultivation by man. The name ALFALFA is that used by the Spaniards; it means "the best fodder plant"; the name LUCERNE is from the French. For over two thousand years it has been cultivated in Europe; it was introduced first from Persia into Greece. From Europe it has spread over the rest of the world, wherever a temperate climate prevails. It was brought first into Ontario about forty years ago. In recent years its introduction throughout the Province has been extending very rapidly as its many good qualities have become recognized, and as the proper methods of cultivation have become known.

ALFALFA A LEGUME.—Alfalfa belongs to that large class of plants called Legumes; the clovers, peas, beans and vetches are legumes also; although Alfalfa is sometimes called a clover, it is not a true clover. Besides having flowers very similar in structure, all these plants have little swellings, called tubercles, or nodules, on their roots, caused by the growth of minute plants, called bacteria; these have the power to take up the Nitrogen from the air in the soil about the roots, and change it into plant substances; the bacteria are beneficial to the plant. Other plants, such as wheat or barley, cannot use the Nitrogen of the air in this way as a food, but must secure their supplies from the soil. The legumes are called Nitrogen collectors, while other plants are Nitrogen consumers. It can be understood then that legumes will enrich the soil when they are plowed under; they furnish a manure rich in the most expensive ingredient of fertilizers, *i.e.* Nitrogen.

GOOD GROWTH REQUIRES THE PRESENCE OF NODULES.—Unless the nodule-forming bacteria are present from a previous crop, it is usually beneficial to inoculate the seed or soil artificially. For any of the legumes this can be done by treating the seed with a culture supplied from the Bacteriological Department of the Ontario Agricultural College (seed inoculation). Soil taken from an Alfalfa field, or from where Sweet Clover is growing, will answer for Alfalfa as well as the culture (soil inoculation).

USES OF ALFALFA.—Its chief uses are for the production of hay, green fodder, pasture and seed. It may be used also for green manure, silage or a cover crop in orchards. The hay is even richer and more nutritious than Red Clover hay; it is relished by every class of farm stock, and is recommended particularly for milking cows, young growing animals and laying hens. The green fodder is very appetizing and nourishing, and is usually available even in a very hot season when the grass pastures are dried up. As a rule fields should not be pastured for a year or so after seeding, and even then close pasturing will often kill the plants. There is need of care, in some cases, to prevent animals from overeating and bloating when pasturing on Alfalfa. There is a strong demand for the seed at present; some of the Ontario grown seed is recognized as very hardy, and has found ready markets abroad.

Alfalfa is made into silage, as a rule, only when the crop cannot be dried into hay. As it is most suitable for a permanent crop, its use as a green manure or as an orchard cover crop is not common, and is not recommended.

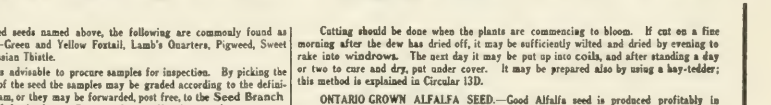
Alfalfa does not take the place of clover in a short system of crop rotation. When a good field is established it is desirable to crop it for a long term of years. Some fields in Ontario have been in Alfalfa continuously for over twenty years.

SOIL.—The young Alfalfa plant is tender at first until it becomes well established in the soil. It therefore requires a clean, rich, well cultivated surface soil in which to make a vigorous growth in its youth. An analysis of the ashes of Alfalfa proves that it feeds heavily on lime; it therefore requires a soil well supplied with limestone. Its roots tend to grow downwards to great depths, but they will not grow into wet layers of soil; it therefore requires a deep, well drained sub-soil; if the ground is not naturally underdrained, artificial underdrains will be necessary; when sown in a field in which the water-table is within a foot-and-a-half or two feet of the surface the crop will not likely be very permanent; a water-table at a depth of seven or eight feet is desirable. The roots grow very strong; they will grow into permeable clay sub-soils, and through great depths of sand and gravel; they cannot penetrate a hard-pan sub-soil, however. The plant thrives often on knolls and hill-sides; in wet or poorly drained hollows it becomes killed out. It will be seen that the nature of the sub-soil is of even more importance than the surface soil.

SEED.—Only the best quality of seed should be used, and this should be, by preference, grown in Ontario, or in a country where the climate is similar to that of Ontario. Experiments on the Provincial Experimental Farm at Guelph have shown that the variety known as Ontario Variegated Alfalfa is very suitable as it is a hardy Alfalfa that has become well naturalized in the Province during the past forty years; and that the seed produced in warm countries, such as Peru or Arabia, does not produce plants hardy enough to withstand our winters.

GRADES OF SEED.—In an Act, called the "Seed Control Act, 1911," the Parliament of Canada has defined the different grades of Alfalfa seed that may be sold by dealers. The worst weed impurities found in Alfalfa, as well as in clover, grass seed and seed grain, have been designated Noxious Weeds, and these are specially prohibited. The grades and impurities are shown in the following diagram. The noxious weeds most commonly found in Alfalfa are Ribgrass, Curled Dock, Chicory, Wild Carrot, Dodder and Ragweed. It should be noticed that any one of the grades might be called "Government Standard" seed; this term has been much misunderstood.

Standards of Quality of Alfalfa Seed		
Grade of Seed	Total Weed Seeds (No. of Noxious Weed Seeds Prohibited in Brackets) Per 5 Grammes in 10 Grammes	
Extra No. 1	30	0
No. 1.	100	5
No. 2.	200	20
No. 3.	400	80



Besides the noxious weed seeds named above, the following are commonly found as impurities in Alfalfa seed:—Green and Yellow Foxtail, Lamb's Quarters, Pigweed, Sweet Clover, Black Medick and Russian Thistle.

Before buying seed it is advisable to procure samples for inspection. By picking the weed seeds out of one ounce of the seed the samples may be graded according to the definitions given above in the diagram, or they may be forwarded, post free, to the Seed Branch Dominion Department of Agriculture, Ottawa, for an official test and report.

SEEDING AND FIRST YEAR'S CARE.—Alfalfa may be sown successfully at different times. In the early spring it may be sown on winter wheat, either on the old snow or on a fresh snow of one or two inches, and no harrowing or cultivation is necessary. Later, when the land is sufficiently dry, it may be sown successfully on a well prepared seed bed, with barley, wheat or rye used as a nurse crop. The land should be harrowed lightly after sowing. As late as July, Alfalfa may be sown also, provided there has been rain sufficient to supply moisture for good germination; in this case it is sown alone on a summer fallow. Fall seeding has not been very successful on the Experimental Farm at Guelph. About twenty pounds of Alfalfa seed is used to the acre, and one bushel of barley, wheat or rye.

The first year of the plant's life is the critical period. Everything should be done to have it well established and hardy in order to withstand the winter. The nurse crop should be removed just as soon as it is ready, cutting about six inches from the ground.

VALUE OF ALFALFA CROP.—On account of its vigorous growth Alfalfa may be cut for hay at intervals in the same season. If the season is very favorable, four cuttings may be made; if the season is very dry, two cuttings may be all that can be made. At the Agricultural College the cuttings have averaged three for each season in the past fourteen years. The average yield of green crop for each year has been over twenty-one tons to the acre, and the yield of hay made from this a little over five tons each year. As this hay is very rich in nutritive substances it is seen to be a very valuable crop. The hay is considered to be nearly equal to wheat bran in feeding value. For winter feeding, Alfalfa hay and corn silage combined make a very satisfactory ration, and is becoming more and more extensively used. Finely ground hay is now sold as Alfalfa Meal.

ALFALFA HAY.—Considerable care is required to make good Alfalfa Hay. The most valuable part of the hay is the leaves of the plant. As extreme drying causes these to break off, the hay has to be cured, if possible, without too much handling or excessive drying; on the other hand, it is easily injured by rain or wet weather. If allowed to mature too far before cutting, the plants will become too woody, and thus make a less digestible hay.

Cutting should be done when the plants are commencing to bloom. If cut on a fine morning after the dew has dried off, it may be sufficiently wilted and dried by evening to rake into windrows. The next day it may be put up into coils, and after standing a day or two to cure and dry, put under cover. It may be prepared also by using a hay-tedder; this method is explained in Circular 13D.

ONTARIO GROWN ALFALFA SEED.—Good Alfalfa seed is produced profitably in Ontario, and such seed will be found most suitable for sowing in this Province. The second cutting is the one generally used for seed production.

The crop is cut when the seed is sufficiently ripened, as shown by the dark brown or black pods. Some cut with a mower, some with a reaper, others use a binder. The threshing is done chiefly with the clover-machine. According to Professor Zavitz' investigations the average yield is a little over two bushels to the acre, but yields as high as seven bushels are occasionally obtained.

REFERENCES.—For further information regarding the kind of soil best suited to Alfalfa, the preparation of the seed bed, the care of the plot during the first year, the method of curing the hay, its use in feeding and its composition, read: Central Experimental Farm, Bulletin 46, published by the Dominion Department of Agriculture, Ottawa; and Ontario Agricultural College, Bulletin 165, published by the Ontario Department of Agriculture, Toronto. These are sent free on application.

The agricultural papers very frequently have articles on these subjects also.

TO MOUNT THIS CHART ON COTTON.—Tack the cotton, stretched to remove wrinkles, to a smooth table top. Make a paste of bread flour, having it free of lumps and this rather than thick. Cover the underside of the paper with the paste, brushing it in well over the whole surface. Apply the chart to the cotton, spreading it over from the top. Smooth the paper onto the cotton by rubbing from the centre outwards. Leave to dry over night. Trim off the cotton about the edges.

NOTE.—This School Chart will be sent to Farmers' Clubs, Women's Institutes and other similar organizations on application.

A SCHOOL PLOT OF ALFALFA.—Any school in Ontario, which wishes to grow a plot of Alfalfa, will be furnished with sufficient choice Extra No. 1 Seed to sow one square rod.

Apply to the Director of Elementary Agricultural Education, Ontario Agricultural College, Guelph.

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In addition to the charts, circulars and instruction sheets have also been prepared and distributed with the seed. Many teachers report these to have been useful in connection with the practical work.

One illustration will suffice to show the plan of the work and the results that may be attained. One of the charts as mentioned was on "The Best Time to Sow Spring Grain." With this there was sent out a circular dealing with the matter at more length and suggesting studies based on practical work. In addition, seed to demonstrate the teachings of the chart and circular were sent out to the schools. Though the unfavorable season prevented very good results in many cases, still a number of good reports have been received.

The following is from Master Ernst Maeder, pupil in S. S. No. 1 Wilmot, New Dundee, Waterloo County. The report was made on a blank page in the circular and forwarded by the teacher, Mr. A. F. Hansuld.

Barley.	First Plot.	Second Plot.	Third Plot.	Fourth Plot.
Date of seeding.....	10th May	23rd May	21st May	12th June
Date of germination.....	20th May	29th May	6th June	16th June
Height of straw	22 inches	22 inches	21 inches	19 inches
Yield on plot.....	1 1/5 lbs.	24/25 lbs.	18/25 lbs.	12/25 lbs.
Estimated yield in bushels per acre	25 bushels	20 bushels	15 bushels	10 bushels
Quality of seed.....	Good	Fair	Fair	Small

Remarks: How the work was carried out, difficulties, lessons learned, arrangements for looking after the plot, etc.

1st.—Sown on sod. Snow storm three days after seeding. Weather was *very wet* and cool from the 10th to the 20th of May.

2nd.—From May 23rd to May 29th, the weather was favourable.

For 1913 the same kind of work is proposed with some re-arrangements and additions. Instead of selling seed, it will be sent out free and always with the stipulation that it is to be used strictly for educational purposes. We will go forward, too, in promoting the formation of School Progress Clubs, sending out select oats, corn, and possibly potatoes for pupils' use.

There are splendid prospects for large and valuable developments in this side of Experimental Union work. Two hundred and fifty schools in 1912! When can we co-operate with the 5,000 rural schools of Ontario?

CO-OPERATIVE EXPERIMENTS IN WEED ERADICTION, 1912.

PROF. J. E. HOWITT, O.A.C., GUELPH, ONT.

This is a new line of experimental work commenced last year, 1912. The object of this work is to have carried on by men of their own farms, experiments in the eradication of weeds, the results of which will furnish data from which definite statements may be made regarding the best methods of controlling the various bad weeds. At the present time it is very hard to get any two men to agree as to which is the best way of handling any particular weed. Then, again, a man may have tried a method on one kind of soil and found it satisfactory and recommended it, but it may not be a suitable method for some other kind of soil. With-

out illustrating further, it is sufficient to say that we have very little definite knowledge concerning the eradication of weeds, and hence the necessity of such experiments.

In starting this work it was thought wise to confine our attention for the first year to four of our common troublesome weeds. If the experiments progress satisfactorily it is hoped to add more bad weeds from year to year until exact information has been obtained about the eradication of most of the worst weeds of Ontario. The weeds selected for the experiments in 1912 were perennial sow thistle, twitch grass, bladder campion, and wild mustard. Six experiments in all were outlined, namely, the use of rape in the destruction of perennial sow thistle, a system of intensive cropping for the eradication of perennial sow thistle, the use of rape in the destruction of twitch grass, a method of cultivation and cropping for the extermination of twitch grass, a method for the eradication of bladder campion, spraying with iron sulphate to destroy mustard in cereal crops. Some nine hundred application forms and leaflets explaining the nature of the work, were sent out to men who had shown special interest in the weed problem.

The results of the work of 1912 have been a little disappointing. From the nine hundred application forms distributed, only forty applications for experiments were received. To those who applied detailed directions for the carrying out of the experiment selected were sent and this fall they were supplied with blank forms on which to report the results of experiments. Only ten good reports were received. Many of those who applied for experiments found it impossible to carry them out on account of the very wet season. From the ten satisfactory reports received, however, some little definite information has been gathered.

The directions given for the experiments are as follows:

Experiment I.—The Use of Rape in the Destruction of Perennial Sow Thistle.

Cultivate the field until about the middle of June, running over it frequently with the cultivator so as to keep the tops down and thus weaken the "roots." Then apply manure at the rate of about twenty tons per acre (twelve good loads). Cultivate the manure in thoroughly, and with a double mould board plow, slightly ridge up the land, making the ridges about twenty-six inches apart. On the ridges sow pasture rape at the rate of one and one-half pounds per acre. It is important that the right amount of rape should be sown, for if too little is sown the stand will not be thick enough to smother the weeds, and if, on the other hand, too much is sown the plants will be too crowded and not grow vigorously enough to keep ahead of the thistle. Sow the rape when the land is sufficiently moist to insure quick germination of the seed. If the rape is slow in starting the Sow Thistle may get a start in the rows and thus necessitate hand cultivation there. Cultivate the rape every week or ten days until it occupies all the ground and makes further cultivation impossible. If when the rape is cut or pastured, any Sow Thistle remain, the field should be ridged up the last thing in the fall and put in with a hoed crop the following year. This should not be necessary if a good stand of rape is secured.

Experiment II.—A System of Intensive Cropping and Cultivation, Using Winter Rye Followed by Turnips, Rape or Buckwheat, for Eradicating Perennial Sow Thistle.

As soon as a cereal crop is harvested, plow the land and give frequent cultivation to the first or middle of September. Then sow winter rye at the rate of about

two bushels per acre. This can be pastured the following spring, or cut for hay or grain. As soon as the crop is off the land, put in rape, turnips or buckwheat. The advantage of this system is that three crops are harvested in two years and the Sow Thistle fought at the same time.

Experiment III.—The Use of Rape in the Destruction of Twitch Grass.

Cultivate the field until about the middle of June, running over it frequently with the cultivator so as to keep the tops down and thus weaken the "roots." Then apply manure at the rate of about twenty tons per acre (twelve good loads). Cultivate the manure in thoroughly, and with a double mould board plow, slightly ridge up the land, making the ridges about twenty-six inches apart. On the ridges sow pasture rape at the rate of one and one-half pounds per acre. It is important that the right amount of rape should be sown, for if too little is sown the stand will not be thick enough to smother the weeds, and if, on the other hand, too much is sown the plants will be too crowded and not grow vigorously enough to keep ahead of the Twitch Grass. Sow the rape when the land is sufficiently moist to insure quick germination of the seed. If the rape is slow in starting, the Twitch Grass may get a start in the rows and thus necessitate hand cultivation there. Cultivate the rape every week or ten days until it occupies all the ground and makes further cultivation impossible. If, when the rape is cut or pastured, any Twitch Grass remains, the fields should be ridged up the last thing in the fall and put in with a hoed crop the following year. This should not be necessary if a good stand of rape is secured.

Experiment IV.—The Method of Cultivation and Cropping for the Destruction of Twitch Grass.

Early in the spring gang-plow the field, or, if in sod, hand plow about three inches deep and harrow thoroughly. Then cultivate with a cultivator provided with wide points which overlap so as to cut off every plant two or three inches below the surface of the soil. Repeat this cultivation as often as may be required to prevent the plants from showing any growth above ground until about the middle of June. Then sow a bushel and a half of buckwheat per acre. The crop of buckwheat may be plowed under as a green manure, or harvested, and the field plowed. In either case, after plowing, continue the frequent and thorough cultivation until the land freezes. The next spring cultivate as soon as possible and repeat the cultivation frequently enough to prevent the Twitch Grass from making any growth above ground, until it is time to put in a hoed crop. The hoed crop must be frequently and thoroughly cultivated in order to be effective.

Experiment V.—Method for the Eradication of Bladder Campion or Cow Bell.

Badly infested fields should be plowed deeply and then thoroughly cultivated and cross-cultivated with a broad-shared cultivator in order to break up and weaken the underground rootstocks. This cultivation should be given frequently enough to prevent the plants making any growth above ground until it is time to put in a hoed crop, which must be kept thoroughly clean in order to be effective. A well cared-for crop of corn has been found to give excellent results. Special attention must be given to hoeing out any patches of Bladder Campion which may appear in the corn crop, and which are not destroyed by cultivation. If in the fall there

is any Bladder Campion in the field, it will be necessary to plow fairly deep and cultivate thoroughly, and the following spring repeat the frequent cultivation until it is time to put in a hoed crop. This second hoed crop should not be necessary under ordinary conditions. One spring's thorough cultivation, followed by a well cared-for hoed crop should destroy practically all the Bladder Campion.

Experiment VI.—Spraying with Iron Sulphate to Destroy Mustard in Cereal Crops.

Iron sulphate or copper can be successfully used to destroy Mustard in standing grain without injury to the crop.

Preparation of Solution. A twenty per cent. solution should be applied. This can be prepared by dissolving eighty pounds of Iron Sulphate in forty gallons of water. Iron Sulphate is dissolved quite readily in cold water. The solution should be strained through a cheese cloth, as it is put into the spray pump tank. This will remove dirt and small particles that are apt to clog the nozzles.

Time to Apply. Apply on a calm, clear day, just as soon as the first few plants in the field show flowers. *It is very important to spray early.* If the plants are left too long the treatment is not nearly so effective. If a heavy rain comes within 24 hours after the solution is applied, it will be necessary to spray again.

How to Apply the Solution. An ordinary hand pump barrel sprayer, such as is employed to spray fruit trees may be used, or a potato sprayer can be rigged up to do the work. Many of the up-to-date potato sprayers have a special broad-cast attachment for spraying weeds. These are excellent for large areas, as they cover a wide strip at each round. Care must be taken to see that every mustard plant is covered with the solution in the form of fine spray. It is important to apply with good pressure.

Iron sulphate may be obtained at any hardware store or from the American Steel and Wire Company, 30 Church Street, New York. In wholesale lots, it is better purchased from this Company, which can supply it much cheaper in large quantities than it can be purchased at local hardware stores.

Killing Mustard with Blue-stone. The demonstrations given throughout Ontario for the destruction of wild mustard have proved that, in the majority of cases, under favorable conditions, spraying with copper-sulphate almost entirely prevents this troublesome weed from seeding in cereal crops.

I. *How the Blue-Stone is Applied.* Place an ordinary spray pump, to which attach the six-row sprayer, on a cart or light waggon; drive along slowly through the field, applying the solution to the mustard plants in the form of a fine spray. When the field is badly infested, it is advisable to spray the crop in strips in order that no mustard plants may escape the spray.

II. *How the Blue-Stone Solution is Made.* Put nine pounds of Blue-stone (Copper sulphate) in a coarse sack or bag, and suspend it in a vessel containing three gallons of very hot or boiling water. The Blue-stone will usually dissolve in 15 or 20 minutes. Strain the solution into the barrel of the spray-pump, and fill up with cold water to make 40 or 50 gallons.

III. *When to Spray the Mustard Plants.* Spray the mustard on a calm, bright day, just as the plants are coming into bloom. Should a heavy rain come immediately after spraying, it will be necessary to spray again.

IV. *How much is Required to Spray an Acre Thoroughly?* A barrel of the solution, costing about 80 or 90 cents, is sufficient for an acre. Successful results are obtained when the spraying is done thoroughly.

V. *Are the Crops in Which Mustard is Growing Hurt by the Spray?* Experience shows that the young wheat, barley, oats or young clover plants are not injured beyond a slight browning for a few days by the Blue-stone spray.

Reports on Co-operative Weed Experiment No. 1.

The Use of Rape in the Destruction of Perennial Sow Thistle.

Two good reports were received from men who had tried this method. One man reports as follows:—

"Began cultivation about the 1st of June and cultivated four or five times using the harrow and scuffler; applied manure as recommended in the directions and sowed rape in drills on the 29th of June; cultivated the rape once and secured a good stand. When the rape was pastured, no Perennial Sow Thistles were to be seen in the field."

The experimenter comments on the experiment as follows:

"I consider this experiment a success, but I think that it all depends on the securing of a good stand of rape so as to make a good cover with which to smother the thistles. I think this season was a good one to prove this method, because owing to the wet weather I have never seen so many Sow Thistles before on other parts of my place."

The other man reports as follows:

"Plowed the land just after the spring seeding was done and cultivated about four or five times, or about every two weeks, using a Peter Hamilton cultivator with broad shares; applied the manure as nearly as possible as recommended, and sowed the rape about the end of July, it being impossible to sow sooner on account of the wet weather. Did not cultivate the rape as I sowed it broadcast; a good stand of rape was secured, and when it was pastured I did not notice any Sow Thistles in the field. I think this method is a success, and have no suggestions to offer as to how it might be improved."

Reports on Co-operative Weed Experiment No. 3.

The Use of Rape in the Destruction of Twitch Grass.

Two satisfactory reports of the results of this method were received. Experimenter No. 1 reports as follows:

"Began cultivation on May 1st, cultivated the field five times before sowing the rape using a Massey-Harris Spring Tooth cultivator with narrow points; did not apply the manure as recommended as the piece of land was a rich hollow that had been heavily manured the year before. Sowed the rape in drills about the 15th of July and secured a good stand; cultivated it twice but gave no hand hoeing. When the rape was pastured there was no Twitch Grass to be found in the field. I consider this method a success when the ground is rich and when it gets a very thorough cultivation before the rape is sown. On an average season it would be hard to improve this method. It is, however, essential that the land gets a good working up before the rape is sown."

Experimenter No. 2 reports:

"We started to plow about the 29th of May; cultivated, harrowed and plowed to turn up any fresh roots which were burnt as soon as gathered up. This cultivation was continued every three or four days when possible, making some eight or ten times altogether. We used a Noxon Spring Tooth cultivator drawn by three

horses and given plenty of pressure. We applied manure about seven or eight loads to the acre and sowed the rape between the 12th and 15th of July; the ground was mellow and received a good shower of rain shortly afterwards. Secured a very good stand of rape between twenty and twenty-four inches tall or better. It would have done better if it had not been sown so thickly. On account of the rush of work we sowed it broadcast thinking that it would choke the Twitch Grass better than if in drills, when we had no time to cultivate. We sowed about three and a half pounds per acre. There was no Twitch Grass in the field when the rape was pastured as it grew so rank and thick that nothing else had a chance to grow. After plowing this fall we saw very few new roots and the old ones looked very much set back. I consider this method a success and believe if it were followed up for two seasons it would completely rid a field of Twitch Grass. I think that sowing rape is far ahead of sowing buckwheat and harvesting it. This fall I noticed when plowing that there were twice as many new Twitch Grass roots in the buckwheat ground as there were in the rape, both the rape and the buckwheat being grown on the same field. This field could not have been very much worse with Twitch Grass. I believe it was just one solid mass of roots."

Reports on Co-operative Weed Experiment No. 4.

A Method of Cultivation and Cropping for the Destruction of Twitch Grass.

Two reports were received giving the results of this method as far as could be judged by one season's work, the method requiring two years to complete. Experimenter No. 1 reports as follows:

"Plowed the field on the first of May, cultivated four times using an ordinary Massey-Harris Spring Tooth cultivator. Sowed Buckwheat and harvested the crop. The Twitch Grass was well killed except where the buckwheat did not make a rapid growth. Where the Twitch Grass got started ahead of the buckwheat, it more than held its own."

Experimenter No. 2 reports as follows:

"Plowed the field about the tenth of May; cultivated three times with a Spring Tooth Deering cultivator and sowed buckwheat early. We plowed the buckwheat down when it was in bloom during dry weather. When the buckwheat was plowed down we found that in some places there were a few roots of the Twitch Grass left."

Reports on Co-operative Weed Experiment No. 5.

A Method for the Eradication of Bladder Campion or Cow Bell.

Two reports were received of results obtained with this method. Experimenter No. 1 reports:

"Plowed the field on June 1st about four and one half inches deep; cultivated it three times a week for four weeks, twelve times in all, using a common scuffler. Planted potatoes and gave them good cultivation three times a week. Did not do any hand hoeing and when the potatoes were dug I could not find any Bladder Campion in the field. I consider this method a success but think it might be improved by plowing shallow, about three inches deep the fall before."

Experimenter No. 2 reports:

"Plowed the field about eight inches deep the first week in November, 1911, and cultivated it six times in the spring with a disc harrow, sowed it to buckwheat, dug out any plants that I could find in the field with a shovel and was able to get rid of most of them in this way."

REPORTS ON CO-OPERATIVE WEED EXPERIMENT NO. 6.

Spraying with Iron Sulphate and Copper Sulphate to Destroy Mustard in Cereal Crops.

Two satisfactory reports on this method were received. Experimenter No. 1 reports as follows:

"Sprayed the mustard on June 18th and 19th when the mustard plants were in full bloom. Used Iron Sulphate, applying it with an Aspinwall 4-row potato sprayer using about 40 gallons of the Iron Sulphate solution per acre. Two light showers came within forty-eight hours of spraying. The mustard plants, however, were all killed except a few of the taller plants which were missed in the rows where the sprays crossed. Consider the method a decided success. It cost us between 75 and 80 cents per acre exclusive of labor for two half days."

Experimenter No. 2 reports:

"Sprayed the mustard about the 29th of June, when some of the plants were forming seed pods and some had not yet blossomed. Used Copper Sulphate with a double action power pump; used one barrel of the solution per acre, nine pounds of Copper Sulphate to the forty gallons. It did not rain within forty-eight hours after spraying. The mustard plants were all killed except a few. These, however, did not form seed pods owing to the burning they got. I consider the method a decided success. The cost per acre was sixty-three cents for Copper Sulphate and sixty cents for time, making a total of one dollar and twenty-three cents per acre."

It is hoped to extend these tests next year and to have at least a hundred men carry on experiments. From a hundred reports some very valuable information should be gained regarding the best methods of controlling bad weeds.

A MEMBER: Having regard to the prevailing prices of iron and copper sulphate in Canada, did you find the copper sulphate cheaper?

PROF. HOWITT: This man with the iron sulphate found that it cost him between 75 and 80 cents per acre. One man here who used copper sulphate claimed it cost him 63 cents. So you see that the iron sulphate is a little more expensive, but we find that the granulated iron sulphate is a great deal easier to handle, it comes into solution more readily, and is on the whole more satisfactory. The copper sulphate takes longer to get into solution, and it is harder to work with.

A MEMBER: Did you sow your rape on the level or in drills?

PROF. HOWITT: In drills.

A MEMBER: I have great doubts as to either rape or any other cover crop smothering weeds. I believe in thorough cultivation.

PROF. HOWITT: In reply to that I may say that I have had an opportunity of observing fields that have been sown both broadcast and in drills, and in those fields that were cultivated thoroughly, the rape sown in drills, and a good stand secured, at the end of the season no Twitch Grass could be found, while in those fields where a poor stand of rape was secured some Twitch Grass was to be seen at the end of the trial. This is evidence of the smothering effect of the cover crop.

MR. CLARK: I have spent quite a bit of time during the past summer driving in different parts of the Province of Ontario, and the other Provinces, and it is a bit depressing in some of the districts through which I passed, to see farms almost overrun with weeds. When we come to look into the causes it is largely attributable to the fact that farmers do not care to pay $35 or $40 a month for farm labor to fight weeds. Now, in districts where the labor is very scarce and

expensive, and where weeds have almost claimed the land, I think I would be disposed to urge upon farmers who are undertaking to cultivate more land than they really can do, and do well, to seed down a considerable portion of it, using some of the finer grasses. This year Kentucky Blue Grass is very cheap. Use a mixture of grass and seed it down. I am speaking now of land which is polluted with mustard and other annuals, not perennials. Seed it down for a period of perhaps seven years, and in the meantime working as much land as they can work well and keep clean. I have frequently been asked the question "How long will these mustard seeds retain their fertility when embedded in the soil?" Most people contend that mustard seed will live in the land for a great many years. About five years ago we got some of the experiments conducted by the staff of the Department at Washington. I was sure that they were wrong, and undertook to prove to my satisfaction that they were in error. I would almost challenge any person to find me a mustard seed that has been embedded in the soil or kept in storage for longer than 15 years that would produce a plant. In Manitoba, I knew of a field that was very badly infested with wild oats, so badly infested that it did not pay to produce a cereal crop on it. The farmer who owned it seeded it with a grass which forms a very compact sod. The work was done under the direction of a graduate of the Manitoba School of Agriculture. After three years he began to break up a small piece of that field for his potato patch, and he broke up a piece each year, and at the end of seven years there was no wild oats. On the farm on which I was raised we had one particular field covered with mustard each year. It was impossible on that field to keep out mustard. When I was going to school—I would be about ten years of age—they changed the road, which now runs through that field. Three years ago I was visiting at home, and spent about an hour and one half along the roadside which has been in sod for that length of time, and where sheep were pasturing on the roadside at the time, and along in that old sod, I still found a few, a very few, inconspicuous plants of mustard, some with half a leaf—the other had been taken by the sheep—and yet that seed ripened. I found quite a few of those plants. This is largely my experience of getting mustard in an old meadow after it has been in sod for 25 or 30 years.

A MEMBER: Do you think wild oats will disappear after they have been in sod for about seven years?

ANSWER: Yes, I am sure of it. In the Province of Quebec it is customary in seeding down a meadow, to leave it as long as it will cut any hay at all, and in the Province of Quebec, wild oats are not considered at all.

W. J. LENNOX: Referring to the question of the killing of Twitch Grass with rape, my brother had an experiment this summer, commencing last fall, similar to what Prof. Howitt has recommended. In the fall of 1911 this field was plowed and left over until spring. The spring of 1912 was unusually wet, and it was late when he commenced his cultivation, but by going over the field once each way with the 2-inch tooth on the stiff tooth cultivator and following later with the 10-inch tooth on the same cultivator, he carried this principle out as often as he thought he could possibly afford the time. He continued the cultivation until the 10th of July, when he sowed rape, without manure, not in drills, but broadcast. This fall I happened to be around just before the cattle were turned on this rape. It was easily twenty inches high, and was very thick, giving a good pasture crop. After it was plowed this fall to the depth of about four inches, I asked my brother if he could find any Twitch Grass, and he said "No." I believe this means is

effective in killing twitch. It is just possible that there might be a few roots next year, but he is likely to follow that field with a summer fallow, so there is no doubt, but that the Twitch Grass will be killed.

Then in connection with wild oats, I might say we had experience some years ago, when we had a field badly affected with wild oats. It was seeded down for ten years. After being broken up, there was but one small patch of wild oats in the field, and, if I can remember correctly, that portion of the field had never a good catch. I believe that field was well cleaned of wild oats simply because it had been seeded down for the ten years.

A MEMBER: Will wild oats grow on sandy soil?

MR. CLARK: They grow on any soil. They are not difficult to get rid of at all.

A MEMBER: Does the law limit the amount of weeds we are allowed to grow on the farm?

MR. CLARK: Yes, there is a very good Provincial law.

PROF. HOWITT: There is a provincial law prohibiting the growth of weeds on the roadsides, and in vacant lands, and that law is so worded that if you are active and keen in your own municipality you can have some attention paid to it, but so far as I can see the law is a dead letter with the present means of enforcing it. It is put in force in this way, although I cannot remember the exact words: "The municipality has power to appoint an inspector whose duty it shall be to go around and see that certain weeds on the roadsides, and on vacant lands that are not under crop are cut." I believe he also has the power to hire somebody to cut the weeds and then charge it up against the property. This law is so made that, if perennial sow thistle or any other weed is bad in that locality, the Councillors can add it to the list that the Inspector shall look after.

A MEMBER: Would you tell me how the Farmers' Club, for instance, could take action to force the Council to act and appoint an inspector?

PROF. HOWITT: Yes, if a Farmers' Club would get together and fifty ratepayers sign a petition, and that petition was forwarded to the Council, it would be the duty of that Council to appoint an inspector.

F. C. HART: The trouble with the matter is this, that the Council appoints a local man and this inspector must proceed against his own neighbors, if he carries out the law. It would be much better to have a man come from outside the district who would not be afraid of enforcing the law. This inspector is paid for his trouble by receiving a half of the fine, so that he gets his money from his neighbors, and a man cannot live in a neighborhood and do that kind of thing. Consequently, they cannot do the work under this law.

PROF. HOWITT: In my opinion this law can only be enforced by appointing outside inspectors.

A MEMBER: We had that difficulty this summer. Can you force a railway company to cut the weeds along the railway tracks?

PROF. HOWITT: Certainly. That is provided for by the law, compelling the railway to cut the weeds along their road allowance:

"It shall be the duty of the inspector to give, or cause to be given, notice in writing to the owner or occupant of any land within the municipality whereon the said noxious weeds are growing and in danger of going to seed (and in the case of property of a railway company, the notice shall be given to any station master of the company resident in or nearest to the municipality), requiring him to cause the same to be cut down or destroyed within ten days from the service of the notice; and it shall be the duty of the inspector to give or cause to be given such notice for the first time not later than such date or dates in each year as may be fixed by by-law of the municipality."

"In case such owner or occupant of land (or, if it be railway property, then the station master upon whom notice has been served), refuses or neglects to cut down or destroy all or any of the said noxious weeds within the period aforesaid, the inspector shall enter upon the land and cause such weeds to be cut down or destroyed with as little damage to growing crops as may be, and he shall not be liable to be sued therefor; or the inspector, instead of entering upon the land and causing such weeds to be cut down or destroyed, may lay information before any justice of the peace as to such refusal or neglect, and such owner or occupant shall, upon conviction, be liable to the penalties imposed by section 9 of this Act; but no inspector shall have the power to cut down or destroy noxious weeds on any land sown with grain."

A MEMBER: I would like to make one or two observations. I am delighted with the prospects that have come in as a result of the beginning of this work of determining what is the best method to pursue in the eradication of wild mustard, twitch grass, bladder campion, and perennial sow thistle. I remember this month of June was pretty dry, it was dry up to the middle of July in most parts of our Province. I think that is the proper time to fight these weeds, but it is very important to put on the rape or buckwheat to finish the job, to keep them from working up. This method that has been adopted seems to be quite effectual, as there is a good covering to smother them out. I believe we are on the right track.

A MEMBER: I may say in our municipality there is no inspector; but we have a pathmaster.

PROF. HOWITT: It should not be left to him.

A MEMBER: Is not there some law in the Northwest that will limit the amount of weeds they can grow on a farm?

MR. CLARK: Yes. I know in some districts where they are trying very hard to secure the observance of the law, but they are having great difficulty.

PROF. HOWITT: In my opinion this matter of legislation against weeds will never be successful until we get the sentiment of the whole community behind it. And I believe this work will be best done by our District Representatives and the Farmer's Clubs. When we have the sympathy and the sentiment behind such prohibitory measures, then they will be comparatively easily enforced.

SHORT POPULAR REPORTS GIVING THE IMPORTANT RESULTS OF FIELD PLOT EXPERIMENTS CONDUCTED BY THE COUNTY REPRESENTATIVES.

F. C. HART, GALT.

Prof. Zavitz wrote letters to some of the district representatives in regard to this topic, and he has given me the answers to some of those letters, and asked me to deal with them. In looking over them I find that there are very few results that can be given to you in concrete form for one reason or another, principally because the men have not been at their stations for a very long time and so the results of their experiments are not at all conclusive.

However, I find among the lot, one from Mr. Collins at Fort William which contains a few points that will be of value, so that I will read at least part of Mr. Collins' report:

On D. C. Garver's farm in the Slate River Valley a very interesting experiment was conducted with alfalfa. One-half acre of ground was divided into four plots. Two plots were seeded with Grimm's alfalfa and the other two with Variegated alfalfa, and one plot of each was inoculated and the other was not

inoculated. The purpose of the experiment was to compare the two strains of seed as well as to show the value of inoculation. In both cases the inoculated plots gave the best results; there being almost double the growth on these plots at the end of July that there was on the uninoculated plots, and the alfalfa was far more healthy in appearance and remained green all summer and fall. The alfalfa on the plots which were not inoculated commenced to turn yellow about the middle of July, and much of it was quite sick by the first of September. Nodules were not present on the roots of these plants, while they were abundant on the roots of the plants on the inoculated plots. Of the two strains of seed, the Variegated gave the better stand of crop, the plants were stronger and more vigorous in growth; but it is claimed that the Grimm's is very hardy and if it withstands the winter better than the Common to any marked degree, it will have served its purpose.

"Four varieties of Swede turnips were tested, viz., Carter's Rose Tankard Swede, Carter's Holborn Elephant Swede, Carter's Holborn Kangaroo Swede, and Carter's Invincible Bronze Swede. These varieties in the order named produced at the rate of 840, 780, 780, and 720 bushels per acre. The plots were one rod by two rods in size. The same four varieties were also tested by several farmers, and although they neglected to obtain the quantity produced, in each case the Rose Tankard Swede was considered the best. The yield was not exceptionally large, but the turnips were very uniform in size, firm and smooth, and of good quality. The turnips of the Holborn Elephant Swede and the Holborn Kangaroo Swede were not uniform in size and both produced rather too many roots.

"Four varieties of potatoes were procured from the Experimental Department at the O. A. C. and tested on small plots. These varieties were Extra Early Eureka, Rose of the North, Early Fortune, and Burpee's Extra Early. Of these four varieties Extra Early Eureka gave the best results, producing at the rate of 300 bushels per acre. Rose of the North and Early Fortune yielded at the rate of 240 bushels per acre, and Burpee's Extra Early produced at the rate of 216 bushels per acre. The variety worth special mention is the Extra Early Eureka. This variety not only gave the largest yield, but also produced the most uniform lot of potatoes in size, shape and quality, and a little over 95 per cent. of the total crop was suitable for marketing.

"Last spring some seed of two varieties of tomatoes was procured from the Horticultural Department at the O. A. C. and this seed was given to Mr. Geo. Sovereign of Conmee Township. In the early part of the spring Mr. Sovereign grew some plants in small boxes in the house, and these plants were set in the open field on the 4th day of June. Bonny Best and Earliana were the two varieties tested, and both of these produced ripe tomatoes during the last week in August; Earliana producing ripe fruit three or four days sooner than Bonny Best. In this case the temptation to taste of the forbidden fruit before it was weighed was too great, and the exact yield cannot be stated; but both varieties produced fair crops, and over one-third of the total crop ripened. This not being a very favorable season for the ripening of tomatoes, Mr. Sovereign is convinced that during an average season these varieties could be made a commercial success in his part of the district."

Now, I do not know that there are very many more points that I could profitably take your time in discussing. Mr. Duncan sends in some very full reports of his experiments at Port Hope, Northumberland and Durham. The point that I did notice in Mr. Duncan's report was with regard to alfalfa seed:

"In the spring of 1911 equal plots were measured out in which to test varieties

of alfalfa as to hardiness, yield, etc., and at the same time to test the different methods of sowing." Then the result of this experiment is detailed, and from the figures the point that I see standing out most prominently is that all the Canadian grown seed gave by far the greatest yield.

Now, in our own experiments down in Waterloo County, we have been carrying them on there for a number of years, and in looking over the results and the large mass of figures that we have gathered, especially with commercial fertilizers, we find results all the way from a loss of $11.75 per acre up to a gain of $98.60 per acre, as a result of using commercial fertilizers with potatoes. In some of our experiments the increase of yield of the potatoes failed to pay for the fertilizer by $11, and in other cases it not only paid for the fertilizer that we used but showed a profit of $98 an acre, results all the way between those two extremes. It is a question of every man testing the fertilizer on his own farm and getting his own results and using the fertilizer intelligently as a result of his own experiments. Perhaps the one point that might be brought out from our experiments with fertilizers in Waterloo County, is that in most of the cases where we have used a phosphate manure on potatoes the increase in yield has been marked, so that apparently a phosphate manure is called for on our soils in South Waterloo, where most of these experiments have been conducted.

Another little experiment with regard to fertilizers that might be of interest—it is not a definite and conclusive experiment, being carried on for only one year, that is the year 1912—is one carried on in our own plots at Galt where we have been using a set of six plots for our fertilizer experiments with potatoes for four or five years, putting the same fertilizer on the same plot every year, until this year 1912. Last spring when we put the potatoes on those plots again, we used no fertilizer of any kind, and conclusively proved that the commercial fertilizers were still in the ground, and had their effect upon the resulting crop, and especially upon those plots that we treated with the phosphate and the potash manure. The nitrate plots did not show the same results as these other fertilizers. I may say that in all our fertilizer experiments we have conducted them on the system of one plot without any fertilizer, one with the three constituents, and the other two or three lacking one of the constituents. In our potato experiments we usually used both the muriate and sulphate of potash. Now, on another set of experiments where we used the full application of barnyard manure on potatoes on one plot, and on the check plot half of the usual application of manure—about 10 tons, and then the series of plots with the half application of manure and the commercial fertilizer—on the plot where we had the barnyard manure only, the full application, we had a profit of $13.00 over the check plot with half a dose of manure; off the plot with half of manure and complete fertilizer we made a profit of $17.00 per acre; on the plot with half manure, but treated with the phosphate and the nitrate manure, we made a profit of $10.70 an acre over the check plot.

In a series of experiments with turnips and mangels where we used the full application of barnyard manure, 20 tons per acre, and also a full application of commercial fertilizers, that is about 200 pounds of the potash fertilizer, of the sulphate of potash, and about 400 pounds of superphosphate, and 150 or 160 of nitrate, where the barnyard manure and the commercial fertilizer were used on the same plots to the full extent, usually the plot, in almost every case, did not pay for the commercial fertilizer. So that it would appear on our soils that commercial fertilizer can be profitably used to supplement part of the barnyard manure application, and has also brought out the fact, I think demonstrated very clearly,

that this fertilizer question is a personal one with each man, because, as I said at the beginning, we have had results all the way from one extreme to the other.

Now, of course, every year we have had a spray test with potatoes, and some years the difference in the yield from sprayed and unsprayed potatoes with various materials has been very marked indeed. From an average of three years in succession from an unsprayed plot we got about 49 bushels per acre, whereas where we sprayed with Bordeaux mixture and arsenate of lead we got a yield of 252 bushels per acre—a very great difference indeed. That has run through all our experiments, and, of course, we have reached the conclusion, and we have no hesitation in stating the fact that the Bordeaux mixture and arsenate of lead, and Bordeaux and Paris green, gave very profitable results. We found usually that both the arsenate of lead and the Paris green have to be applied in a little larger quantities than is usually recommended, and we also found that the arsenate of lead is a little slower in action than the Paris green, but apparently in all our experiments the arsenate of lead has given slightly better results than the Paris green.

We tried another experiment with potatoes for a couple of years. After the potatoes were up in plot No. 1 we cultivated once, another plot we cultivated every 10 days, giving 6 cultivations altogether, and another was cultivated five times after rain. From the plot that was cultivated every 10 days we secured a profit of $19.20 per acre over the yield of the plot that was cultivated only once, while from the one that was cultivated five times after rain we got a profit of $24.50 per acre over the yield of the once cultivated plot. It certainly points out that it pays to put the boy and the horse with the cultivator through the potatoes as often as you can.

Q.—What valuation did you put on the potatoes?

MR. HART: We put a valuation of 50 cents, and then we charged about 50 cents for cultivating an acre of potatoes.

Q.—Was that plot cultivated five times more than the one that was cultivated every 10 days?

MR. HART: No, five times altogether, after five rainstorms.

Q.—Did you not hill them up at all?

MR. HART: No. Our soil is rather light and we just keep them on the level.

Q.—How many times did you cultivate those that you cultivated every 10 days?

MR. HART: About six times.

Q.—How is it the profit off those you cultivated five times was heavier than the one you cultivated six times?

MR. HART: I do not know. It should not be. What I am trying to impress upon you is the fact that these figures, an average of three years' experiments, show that it pays to keep the moisture in the ground and let it get to the potatoes. Cultivate after rains.

Q.—Did you adopt any methods of keeping the weeds down in the uncultivated plots?

MR. HART: No, we just let them go. We just wanted to find out how much we were losing by letting the weeds grow up in the potato patch as naturally as they would.

Q.—If you did not hill up your potatoes, but left them on the level, wouldn't that burn some of them, by being close to the surface?

PROF. ZAVITZ: We carried on experiments in regard to that, and we found that at a depth of one inch, 17 per cent. were effected, at 3 inches 4 per cent. were burnt, and where we planted five or seven inches deep they were not sunburnt at all.

W. E. J. Edwards, Essex.

One of the most interesting experiments which we conducted in Essex in 1912 were variety tests of oats and barley. The results are as follows:

Varieties.	Straw, tons per Acre.	Grain, bu. per Acre.
Oats.		
Banner (Brandon)	2.00	55.29
Victory (Sweden)	1.60	55.29
Gold Rain (Sweden)	1.96	47.05
Lincoln O.A.C.	1.32	37.64
Siberian O.A.C.	1.84	32.94
Abundance (3 bu.)	.80	22.35
Abundance (2½ bu.)	1.48	21.10
Abundance (2 bu.)	.68	22.35
Abundance (1½ bu.)	.84	22.35
Barley.		
Mensury (Klinck)	.96	65.80
O.A.C. No. 21	1.46	63.30
Mandscheuri (Minnesota)	1.60	60.00
Oderbrucker (Michigan)	1.36	57.50
Oderbrucker (Mivart Robinson, Essex)	1.96	48.33
Oderbrucker (J. Ellis, Essex)	1.06	8.30

The following are the results of the corn ear to the row test that we carried on during the summer of the past year. The varieties used were the White Cap Yellow Dent, and the Bailey.

White Cap Yellow Dent.

No. of Row.	Bushels of corn on the cob per acre.
20	131.00
3	123.00
21	117.75
16	117.50
2	117.25
10	116.50
23	112.25
14	112.00
11	111.50
13	111.25
1	110.75
19	108.75
8	106.75
4	105.50
22	105.25
7	102.75
27	101.25
17	101.00
9	98.75
5	96.50
18	96.25
15	94.75
25	85.50
6	80.50
26	77.50
24	54.00

Yellow Dent (Bailey).

No. of Row.	Bushels of corn on the cob per acre.
5	104.50
4	101.00
7	96.25
3	95.50
8	93.50
6	93.00
15	90.50
10	87.50
14	87.50
12	81.00
9	80.50
16	76.50
13	73.50
2	72.50
1	71.50
11	52.75

A number of tests were carried on among the farmers of the county in order to ascertain the value of different methods of seeding alfalfa. We sowed one acre of alfalfa without a nurse crop, and another acre beside it with a nurse crop of about three-quarters bushel of barley per acre. In the autumn very little difference could be seen in the two crops, and it remains to be seen which will stand the winter the best.

We conducted another experiment where we tested a number of different varieties of seed corn, samples of which were obtained from several of the corn States. These were planted beside home grown seed of the same variety. We found that in every case, the crop produced from the home grown seed matured from seven to fourteen days earlier than the same variety grown from seed procured from the States. This is a very important point for ensilage growers throughout the Province, as their corn is often not matured enough to make first class ensilage before the frost comes. The south-western Ontario corn being acclimatized to our conditions naturally matures earlier than the same variety brought from across the border.

REPORT OF COMMITTEE ON IMPORTATION AND DISTRIBUTION OF NOXIOUS WEED SEEDS IN SCREENINGS.

Prof. R. Harcourt, O.A.C., Guelph.

At the annual meeting of this Union in 1903 action was first taken to bring to the attention of the Dominion Government the desirability of in some way regulating the sale of mill by-products. It was contended that there was such a large number of new mill by-products which the cattle feeders were not familiar with, also that there were many proprietary mixtures being made and sold under fancy names which give no indication of their feeding quality. It was felt that it was only right that these substances should be sold according to quality, and this was the stand taken by the Experimental Union. A committee was appointed to take up the matter, and after some years of agitation an Act, known as the "Feeding Stuffs' Act," was passed, and went into effect the first day of January, 1910. According to the terms of this Act, all foods, excepting only the fodders, hays, roots, and chop made from unmixed grains, and the bran and shorts of certain grains, must be sold subject to a guarantee which states the percentage amount of protein, fat and fibre which these foods contain. It was felt that bran, shorts and chop feed could be dealt with under the old Adulteration Act and definitions of these substances were made legal by Order in Council of October 29, 1910, taking effect December 5th the same year.

At the meeting of the Union in 1910 your Committee asked to be dismissed as their duties were completed, but the meeting decided that the same committee should be kept in office and that they should take up the question of the prohibiting of the selling of weed seeds in various mill feeds. Your committee have to report that the definitions of bran, shorts, and chop have been further amended to restrict the sale of weed seeds in these feeds and now read as follows:

"13. Bran is a product of the milling of wheat or other grain, and contains not less than fourteen (14) per cent. of proteids, not less than three (3) per cent. of fat, not more than ten (10) per cent. of crude fibre and must be free from vital seeds of any of the noxious weeds defined by the Governor in Council under 'The Seed Control Act.'

"14. Shorts or Middlings is the coarser material sifted out from the products of a second treatment of the grain by crushing the coarsely ground material that is sifted out from the bran after the first grinding; and contains not less than fifteen (15) per cent. of proteids, not less than four (4) per cent. of fat, not more than eight (8) per cent. of crude fibre and must be free from vital seeds of any of the noxious weeds defined by the Governor in Council under 'The Seed Control Act.'

"15. Chop-feed is whole grain of one or more kinds more or less finely ground, and contains not less than ten (10) per cent. of proteids, not less than two (2) per cent. of fat, not more than ten (10) per cent. of crude fibre and must be free from vital seeds of any of the noxious weeds defined by the Governor in Council under 'The Seed Control Act.'"

This amendment was made legal on May 3rd, 1911, and went into operation on the 7th June of the same year.

Your committee wish to thank the Dominion Seed Commissioner and the officials of the Department of Agriculture at Ottawa for their kindly assistance in the procuring of this valuable legislation, and we trust that the farmers of the Province will take full advantage of it.

A MEMBER: If there are seeds contained in the bran that are ground or partially broken, does that apply?

PROF. HARCOURT: It says "vital seeds."

A MEMBER: It may be half weed seeds?

PROF. HARCOURT: These feeds are subject to the Adulteration Act and are examined as are all other forms of feed materials controlled by that Act.

MR. CLARK: I would like to tell you that the administration of the Act respecting the adulteration of foods comes under the Inland Revenue Department. In the case of the samples of ground feeding stuffs, bran, shorts, chopped foods, they are collected by the officers of the Inland Revenue Department, and after they make their examination in respect to feeding quality, parts of the samples collected are sent to us for examination as to vital weed seeds, the seeds mentioned in the Seed Control Act. They have sent us two collections which have been made since the Act came into force. The amendment referred to is not in itself an Act. It was an Order-in-Council amending the regulations under the Adulteration Act. Prof. Harcourt has recommended the Committee on Weed Seeds in Screenings be discharged. It is my opinion that if there is any time when that Committee would be needed to do useful work, it will be during the next eight years. I do not know just whether the work is one that the Committee as a Committee of the Experimental Union, should be active in, but there is a great deal of work that needs very badly to be done, and a very large problem that needs very careful watching. Two years ago, I stated here that there were upwards of a million and a half bushels of dockage screenings which accumulated each year in the large elevators at Port Arthur and Fort William. That, of course, will increase from year to year. We have at Ottawa been making careful analyses of these screenings. Each car as it comes to Fort William is cleaned by itself, and we find it exceedingly difficult to get any information that can be taken to represent the whole lot. The weed seeds in a car coming from Southern Manitoba will differ very widely from a car coming from Northern Saskatchewan. But when all the lot are taken together we have 25 per cent. of these screenings which are just questionable as to whether they should be used for feed or not. They are valuable in protein and sheep will eat them, but hogs would refuse to eat them. They are of a nature that will kill poultry. About 25 per cent. of them are un-

wholesome as a stock food; that is, seeds that would be separated out by a practical process through a screen with perforation of 1-22nd of an inch in diameter. Another 25 per cent. are excellent feed for sheep, and, I think, probably on the whole not wholesome as feed for cattle. At least 50 per cent. are really excellent and very cheap feed, consisting of shrunken and broken wheat, oats, barley, wild oats, which are entirely wholesome as a feed, wild buckwheat and some other of the weed seeds. The great bulk of these screenings, 95 per cent. of them or more, has been during the past four or five years exported to the United States. They are feed under certain regulations and restrictions. Most of them are sold at prices ranging from six to twelve dollars per ton. And, do you know, the mutton that is produced from those screenings, and on which duty is paid, is being brought back into Canada, and we are paying duty on it. There is a great fund of good feed which our stockmen and farmers know practically nothing about. And I think our committee should take a very active interest in studying what we have there, and devising practical methods by which we can separate out the useless parts, and make it clear to our stockmen in Canada how they can take that and handle it for the use of stock in Ontario without incurring any serious injury.

Prof. Harcourt: Just as an indication of what Mr. Clark was saying about the nature of these weed seeds, I may say that perhaps six weeks or so ago there were two gentlemen in my office who said that their firm was prepared, if the composition of the weed seeds would warrant it, to undertake the question of disposing of the whole of the product at Fort William. Their idea was to destroy the germination of the weeds by heat, press into cakes, export them to Europe for feed. That is their idea. How far they have gone with it I do not know. We analyzed a few samples for them so as to give them some idea of the composition of the material, and gave them a little information as to how they might destroy germination, but I have heard nothing more from them, and do not know what they intend to do. The samples we analyzed averaged 13 per cent. of oil, 14 to 15 per cent. of protein. We have got a great amount of material there which is of great value, and the amount of that material will probably increase because of the increased amount of grain grown in the West.

Prof. Zavitz: The Experimental Union can certainly congratulate themselves that this subject has been brought to a successful issue in this way, and while there are four or five on the committee, I think every one of the members must say that we have to thank Prof. Harcourt, as chairman of the committee, and more particularly Mr. Clark, whom we have with us here to-day, who has taken a very active part in this work all the way along, and is right in touch with it. I think we are more grateful to him than probably any one individual, for bringing this to a successful issue. But, just as he said a moment ago, we have to follow it up if we are to get the real value of the work that has been done.

Duly moved and seconded that the services of the committee be still continued in connection with this work to watch for further developments. Carried.

OPERATION AND VALUE OF THE SEED CONTROL ACT.

Geo. H. Clark, Seed Commissioner, Ottawa.

The enactment of laws having for their object a measure of control over the commerce of seeds presupposes the existence of evils. Ten years ago it was generally assumed that the distribution of farm weeds was closely associated with the trade in grass, clover and other agricultural seeds, but little definite infor-

mation was available. To frame a seed act without reliable information about the nature and extent of the evils to be corrected, would be almost equivalent to a medical practitioner prescribing for a patient before diagnosing the malady. Before our Seed Control Act became law we had the results of quite thorough investigations conducted during the years 1902, 1903 and 1904.

The principal evil, and the first one to be investigated and regulated by law, was the distribution of weed seeds in grass and clover and seed grain.

The matter of the vitality of seeds, particularly of field, root and garden seeds, was next investigated, and in 1908 the Act was amended to apply to the sale of seeds of a low percentage of vitality.

The importation, distribution, and sale of seeds inferior or not true to kind has received attention during the last few years. We have procured samples and made growing tests of every kind and variety of field root seeds, imported, catalogued and put on the retail market during the last two years, so far as our seed inspectors have been able to get them. Our results thus far indicate that the losses sustained by farmers who buy and use seed from some of the imported stocks we have tested, are much greater than would be expected. There can be no excuse for the importation and distribution of the mongrel seed stocks put on the market by some of our seed houses. To control this third and most important quality of farm and garden seeds would entail an annual expenditure of not less than $50,000. It is a problem bristling with difficulties which are not, however, impossible of solution.

Of these three qualities of seeds—purity, vitality and genuineness of stock—the Seed Control Act has been applied to the first for six and to the second for four years. In order to form an opinion of the effect of the Act, we must recall the conditions of the trade before it came into force.

Conditions of the Seed Trade Ten Years Ago: In estimating the world's supply of red clover and alsike seed, the province of Ontario has to be reckoned with. In a favorable year we export upwards of 200,000 bushels of these seeds—about half the red clover and nearly two-thirds of alsike that we produce. Europe is our natural market, but unfortunately for Canadian agriculture European countries were thirty years ahead of us in establishing seed testing and seed control stations. The farmers of Europe demanded, and were willing to pay for, the best quality of clover our seed houses could send them. The cheaper grades were in demand throughout Canada. We were exporting the red clover and alsike seed, that by recleaning could be made of medium and superior quality; and keeping those seeds that would range from medium quality down, for home use, the screenings from the exported seeds finding a ready market in those provinces where red clover and alsike are not commonly grown for seed. If we were to apply our present regulations to the 595 samples of clover seeds taken for investigation from lots exposed for sale in the various provinces during 1902 and 1903, forty-six per cent. would be graded "Rejected" and forbidden from sale. They contained more than 400 weed seeds to the ounce.

Our supplies of timothy seed are largely imported from the United States. The cheaper grades were found to be less objectionable than the cheaper grades of alsike and red clover. Only nineteen per cent. of the samples would be rejected by our present standards. It was a common practice ten years ago to save timothy seed out of fall wheat screenings. It was also a by-product of the hay press in the eastern provinces. We seldom see seed of that quality now.

Alfalfa seed was not commonly seen in the hands of dealers in 1902 and 1903. The samples we then obtained were more dead than dirty. Our supplies are now imported principally from southern Europe; some comes from the United States and we produce perhaps five per cent. of our requirements in Ontario.

Fully ninety-seven per cent. of the grass and clover seeds used in eastern Canada are timothy, red clover, alsike and alfalfa. The small quantities of the finer grass seeds used are imported from Europe, the United States and New Zealand. We raise some Canadian Blue grass seed for export. For several years we doubted our methods for testing these fine grass seeds. We were unable to get the samples to germinate. We have no trouble now, however, in getting a good percentage germination from the same methods.

It was quite possible in 1902 to obtain from seedsmen good clean seed grain. The great bulk, however, was, and still is, supplied by grain merchants. Prior to the enforcement of the Seed Control Act, no distinction was made by them between feed and seed grain. Most of the commercial grain available to farmers for seeding was foul with wild oats, mustards and other weed seeds.

The vitality of the seeds in the retail trade was the subject of investigation for five years, commencing 1903. In 1908 we tested 621 samples of field root and garden vegetable seeds, of which only 91 samples came up to our present standard of germination for good seed of the kind. Practically all of our field root and garden seeds are imported from Europe and the United States.

The Purpose of the Seed Control Act: The aim has never been, and I hope will never be, to compel any farmer or gardener to purchase seed of a better quality than he desires. No process of legislation can make good farmers out of bad ones. But it has been the object to enable the purchaser to procure seed of the quality he desires and is willing to pay for.

To this end, we have established standard grades for the principal grass and clover seeds. When exposed for sale, timothy, red clover, alsike and alfalfa must be graded Extra No. 1, No. 1, No. 2, and No. 3.

Seed grain and seed potatoes sealed in the sack with the metal seal of the Seed Growers' Association are of the best quality available for commerce. Ordinary seed grain must be free from weed seeds or, when exposed for sale, be placarded showing the presence of such seeds.

When purchasing seed grain, grass or clover, farmers now have a reasonable assurance of their purity. We have seen a marked improvement in the demand for these seeds during the last three years. We have abundant evidence that when Canadian farmers are sure of getting the best, they are willing to pay a fair price for it. The demand, which ten years ago was for seeds of a medium quality down, is now for seeds of a medium quality up, with at least 75 per cent. of it for the best available quality of grass and clover seeds.

Legislation pertaining to the vitality of seeds has decreased the danger of crop failure through the unwitting use of seeds of low vitality. It is still possible to purchase seed of low percentage germination, but when the vitality falls below a certain standard that information must be given to the purchaser.

Legislation a Supplement to Education: Some marked changes have been noted in the idea of the value of the different qualities of seeds. We have seen that the effect of our present seed legislation has been to restrict and suppress the distribution and sale of the worst. The Seed Control Act can not of itself, however, create a demand for high class seed; yet there has been a great change in the quality of the seed demanded since the Act came into force. This change has been brought about by various educational agencies. The subject of seeds was quite fully dealt with for several years at Farmers' Institute meetings. It has been a

matter for special study in short courses of agriculture. The agricultural press, the general distribution of bulletins and the illustrated book "Farm Weeds" have had a wholesome influence. Seed fairs, field crop competitions and provincial seed exhibitions have been educational. The inspection of seed crops in the principal clover seed producing districts helped to awaken interest. The Canadian Seed Growers' Association has done splendid work. The seed testing laboratories, both federal and provincial, where farmers and merchants may have their seeds tested free of charge, have served to direct attention to the condition of the seed supply, but in this Province the educational work that is having the most telling effect for better seeds belongs to the district representatives for agriculture. Our seed legislation has served as a necessary supplement to this educational work.

Effect on the Seed Supply: Seed legislation can be applied only for the purpose of regulating the trade. We cannot make laws to create a supply of good seed. If all the seed produced in Canada were required alone for seeding in this country, then our legislation would soon make itself felt on the quality of the seeds. While, however, we export more than half of the clover seeds produced in Ontario, farmers who produce No. 2 quality, according to our standards for grading, will be able to sell it for export at a price very little below that obtained by the farmer who grows clover seeds that will meet our requirements for Extra No. 1. In fixing the standards of quality for the respective grades, it was the endeavor, considering the average supply for five years, to so adjust the proportion of weed seeds that a reasonable amount of the total supply might be considered of No. 1 quality. Our present standard for No. 1 seed allows a total of 100 weed seeds per ounce; yet this year, with a partial failure of our clover seed crop, not more than five per cent. of our homegrown seed will be sufficiently clean and good to be graded No. 1.

The finest and cleanest alfalfa seed comes to us from Italy and Utah; yet this imported seed of fine appearance has less value for Canada than northern grown seed, which is usually irregular in maturing and contains considerable impurities. We are endeavoring to so adjust the grades for alfalfa that our Canadian grown seed may not be discriminated against.

Because of our Seed Act, the Canadian market is now completely closed against screenings and low grades of grass and clover seeds. The demand is small in Canada even for No. 3 quality, yet many of our farmers continue to grow clover seed on land foul with weed seeds. When they take their seed to market they are offended at the low price they are offered for it and commonly take it back home. We have prosecuted a number of farmers for selling such seed to their neighbors, but we find it impossible to police the back concessions over the Ontario public roads in April.

It would be an easy matter to secure the object of the Seed Control Act could we be sure of an abundance of good clean seed. We have evidence that since the Seed Act came into force noxious weeds are not so numerous on the whole, particularly in the grass and clover crop, as they were. But we also know that farm weeds are more generally distributed over the country than they were ten years ago. It was less difficult ten years ago to secure clover seeds that would grade Extra No. 1—that is, clover seeds free from noxious weed seeds—than it is to-day. Clover seeds that by any process of recleaning can be made to conform to our standard for Extra No. 1 are not now produced in Ontario in sufficient quantity for commerce. To meet this year's demand for No. 1 red clover seed our seed houses are raking the world's supply for the best that is offered. We are now receiving dozens of important samples of Mammoth red clover for test and grading,

but very few of them will conform to our standard for No. 1 quality. As a result of these high standards, however, our farmers may have the consolation of knowing that they will get the best and cleanest seed produced in any country in the world.

The supply of our field root and vegetable seeds, which was formerly too frequently of questionable vitality, is now receiving much more attention from seed merchants than ever before. Prior to 1908, few seedsmen systematically tested all their seed stocks for vitality. Our staff employed in the germination laboratory at Ottawa and Calgary has reason to know that very little seed put on the market by Canadian seed merchants has not first been tested for vitality. This was a much needed change, and is one of the most valuable services rendered under the Act.

How the Act is Enforced: For the purpose of administration, we have divided the whole territory into nine main districts and have one permanent officer in charge of each district or province. During the busy season each main district is subdivided and a temporary inspector is given direct charge of a subdivision. Each permanent and temporary inspector reports from day to day on blank forms for the purpose. Thus we are able at any time to quickly refer to the operations of any of our seed dealers in any part of Canada. The reports indicate the kinds and quality of the seed handled, and the records are invaluable when we come to decide how often a seedsman is apt to make mistakes—because seed merchants of course never wilfully disregard the law—and whether one of these mistakes deserves the condemnation of the court.

Our seed inspectors go at least wherever the seed houses send their commercial travellers. The principal distributing centres are always under the watchful eye of our permanent men, and with the assistance of temporary inspectors we endeavor to have each small town visited two or three times during the seed season.

The Future of the Seed Trade: Fifty years ago most Canadian farmers had some personal acquaintance with and occasionally consulted their seedsmen. Now they have plenty of opportunity to make themselves acquainted with his name and have the privilege of consulting his catalogue. The farmer is now able to get his seeds in packets, likewise his patent medicine—both in the same store. The middleman does not profess to have any knowledge of their origin or quality. Rapid and cheap transportation has tended toward the centralization of the brains of the seed business. These changed conditions have been closely followed in most agricultural countries by some measure of governmental control over the seed trade. The operations of modern seedsmen are 99 per cent. business and one per cent. profession. It would be better for agriculture were it 50 per cent. profession.

When we adopt more intensive practices in farming and gardening, more attention will be given to the origin and breeding of our seeds. The progress in plant improvement will soon bring about a great demand for improved seeds. That demand will surely create—in fact, has already created—splendid opportunities for trained agriculturists and horticulturists, who will make the growing and selling of seeds a creditable profession. Let me say to the students and ex-students of this agricultural college that here you get the proper training for the profession of a seedsman. Fifty acres under field root and garden seeds, one variety of each and that of the very best kind and quality, will provide interesting and profitable employment throughout the year for four good men under the leadership and business management of an agricultural college graduate. As a profession it should be highly attractive. As a business it is amply remunerative. The country needs your best endeavors to improve the supply.

T. G. Raynor: Mr. Clark has pretty well covered the general outline of the Seed Control Act, and its work. As a policeman under that law, and having had something like seven years' experience, not under the Act of 1911, but commencing with 1905, I have had a chance to observe some events, and learn some things, because we did not know anything about seeds when we started in, and we do not know all about it yet. During that time it has been our policy to do as much educational work, exchanging ideas with the men who are engaged in the seed trade, as possible; so instead of entering a man's store and trying to spy out everything that he has got on the sly, we go to the man direct and ask him if he knows that there is such a thing as a Seed Control law. All of them know about it now, but in the earlier days some of them were not advised that there was such a law touching their business. So our policy was to enter into that law and to try to make it as clear as possible and tell them how they could protect themselves against being trapped in any way. Now, in connection with our seed trade we have the wholesale house and we have the retail house. Eastern Ontario has been largely engaged in simply retailing out the goods that they received from the large wholesale houses located in Toronto and Montreal and Western Ontario. When we came to Western Ontario we had a different problem to contend with. We often met with local jobbers, men who had a plant in a small way, who sold out to local retailers a certain amount of seeds, and who shipped to other parts of the country. So you see there were a good many problems connected with this work of trying to advise as to what the quality of the seed should be.

Now, we can only get at the value of the Seed Control Act of 1911 by making a few comparisons with the one we started out with. Briefly stating, I may say that the first law simply recognized two grades of seed that was saleable to the trade. The first was seed of first quality, and the second was that which was barely saleable. There was a wide range between what was No. 1 and what was not No. 1, and the old standard was that which the seed merchants followed as the government standard, and that was a kind of a blank clause which covered anything from one noxious weed seed to 1,500. Now, figure that out on the ounce basis, on which the present law is arranged and you will find that in one ounce of Red Clover there might be under the law of 1905 as many noxious weed seeds as 92. It is now limited to 80. So that under present conditions a man goes into a store and wants to buy an ounce of seed, while there are only 100 seeds to the ounce only 5 of those are allowed to be noxious, so that in a pound there would be 80.

I have seen a marked advance in the quality of the seed. This is the way that a seed law effected the wholesale houses. At first they did not know just what attitude we would take regarding the law. But they began to see that they could protect themselves. They aimed then to fix up their machinery and to secure their seed supply from such sources as would meet the requirements of the law. Some dealers we have learned, have traded on the credulity of the farmer. Now, the farmers used to think that when under the law they got government seed, it allowed 92 noxious weed seeds to the pound for good, first-class seed. Now, it was the duty of the inspector to disabuse the minds of the farmers as far as possible that that might not be the government standard. I have learned in my experience that a great many farmers even spent half an hour or an hour examining seed that they were going to buy, and this was a step in the right direction.

Now, one thing that the Seed Control Act of 1905 did, if it did nothing more, was to advise the farmers of Western Ontario that a great many of them had rib grass or buckhorn on the farm. Some of our Western jobbers and local millers got

the very best plant they could. There are several of the plants now equipped in Western Ontario with a buckhorn mill.

Now, when we come to compare the standard of the Seed Control Act of 1911 with the one of 1905, so far as it applies to the small stuff, we find that it is possible to have a grade in which there are only 30 weed seeds, of which none are noxious. That is called in the law extra No. 1. Did you ever see any Extra No. 1 offered in the trade? In our experience last year, none of the dealers ventured to put on the Market Extra No. 1. There were some seeds that measured up to that standard, but they were afraid that if some men found one noxious weed seed in it they would get after them. So that in that respect we do not expect for some time to find many grades of seeds of Extra No. 1. If you can furnish the quality of seed, then our wholesale houses and our dealers will be glad to mark that seed as Extra No. 1. Then comes No. 1 seed, which is allowed to contain not more than 5 noxious weed seeds to the ounce.

Coming down to No. 2 standard, the appearance or general quality in the seed so far as the eye is concerned is not required to be quite as high as in No. 1, and the standard for weed seed impurities is 20 noxious, and 200 weed seeds all told to the ounce, and when I say 200 weed seeds to the ounce, I include those that are noxious.

There is one exception of the small seeds to what I have said, and that is in Alsike. In Alsike there is allowed just double the quantity of noxious weed seeds, but no more of the total of weed seeds to the ounce, as there is in Alfalfa, Red Clover, and Timothy.

Mr. Clark has already spoken about the supply of seed from some sources, in Timothy. Last year was an exceptional year for timothy, especially in the Eastern part of the province, where they had a good crop of timothy for hay. We had some difficulties in some of those seeds measuring up to the requirements of the law, because some of the non-noxious weed seeds were there in a greater proportion than 400 to the ounce.

So that in the enforcement of the law it has not been such a serious problem after all, and when our dealers are fully advised and our farmers understand the nature of the law, it does not appear to be so complex as when you read it through, and the general effect is bound from year to year to encourage the farmers to grow a cleaner quantity of seed. Therefore, the source of the seed being cleaner, we will have a chance, so far as we have clean farms, to get as clean seed as it is possible to get.

Now, I have a conviction that there are many dirty farms throughout the province. There are methods that a farmer can adopt by which he can reduce the presence of noxious weed seeds to a minimum. One of the great difficulties that we have in enforcing the law and applying it, is this very fact which Mr. Clark has referred to, that dealers complain that many farmers on the sidelines and the concessions, are changing seed with one another, seeds of a low vitality and low grade. We have investigated this. It is not as often true as you would think. We have found that many dealers have been dealing in a lower grade seed than the farmers have been selling to their neighbors. There are some farmers who are doing it ignorantly, there are others who are doing it with their eyes wide open, but none more so, I think, than the seed dealers.

I may say that the demand for No. 1 compared with No. 2 and No. 3 grades has wonderfully increased in the last two years. Some of them when they run out of No. 1 put the standard of No. 2 up to No. 1. We, now under our law, have got them pretty well checked in that, because every dealer who is offering seed has or

should have a placard, so that when one is buying seed they can see what they are getting.

These are a few of the problems in working out the application of the law of 1911, and I apprehend that next year or this year at least, and the years to follow will become easier as the years go along.

W. J. LENNOX: I was thinking while listening to the two previous speakers that they each left me very little to say on the matter of the Canadian Seed Control Act. When Mr. Raynor spoke of being seven years in the service and referred to the policeman, I must confess that I have been on the police force but one year. Still, I recognize what is meant by the Seed Control Act, and the work that it is doing in the grading of the Clover Seed. I can quite agree with Mr. Raynor when he said we see very few samples of Extra No. 1 Clover. I had the pleasure of seeing one sample last year, but it was in Prof. Zavitz' office that I saw it.

A previous speaker spoke of the District Representative, and it seems to me that here is where some of the greatest work is being carried on in connection with the Seed Control Act. I found during the past year, that through visiting the District Representatives and keeping in close touch with their work, we have succeeded in educating a great many farmers to a knowledge of the Seed Control Act, who, previous to this time I believe, did not thoroughly understand it. In fact, in some cases they did not know that there was such a law.

One very pleasing experience we had in this respect during last summer was at Orangeville. While out looking over some of the Clover fields we had the pleasure (Mr. Dorrance and myself) of visiting one farmer who had a field of Alsike Clover which looked very pleasing to us. We drove to where this man was working, and explained to him the Seed Control Act, its object, what it meant to him, what it meant to the farmers around him, what it meant to the Province of Ontario and the Dominion of Canada at large, and asked him if he would go with us to his clover, look it over with us and follow our suggestions, and we found the results are fully as we promised. In speaking with him this year he thanked us, and said we had saved him that year a good many dollars from what we had said with reference to the Seed Control Act. It is very likely that if the District Representative had not been in Orangeville that we would not have known anything about this Clover field; and had it been left the way it was, when we saw it, it would have been at least one degree less in quality when it was threshed.

Several things of this kind have impressed firmly upon me that the Seed Control Act has been brought before the attention of the farmers more thoroughly through the District Representatives than by any other means.

I can agree also with the previous speaker when he speaks of the demand for clover seed. My experience has been that the demand for No. 3 Clover, for Alsike, Red Clover, or Alfalfa, is on the decrease. When you speak to the average farmer in the Province of Ontario now, he is enquiring for No. 1, and the list of enquiries this year is very long. Every farmer who wishes to grow clean seed wants No. 1, and really is not content with a No. 2, whereas a few years ago, the majority of farmers were satisfied with the No. 3 grade. I think that is excellent proof of the work which is being done by the Canadian Seed Control Act.

We are frequently questioned from the farmer's standpoint, and also from the seedmen's standpoint. Sometimes a farmer will look rather cross when we mention the Seed Control Act to him. One farmer stated that it was not an act for the farmers at all, and I expressed the opinion that I was delighted to hear him say it, because I really feel that the only way you can explain the Seed Control Act

to a farmer is to get into an argument with him. Of course, after the argument was over he agreed with me that the Seed Control Act was not only a good thing for the farmers of Ontario, but a good thing for the seedmen. I only can say that as far as I am concerned in being a policeman in this work, that I agree with Mr. Raynor when he says that it is our wish to be as friendly with the seedsmen as we possibly can, to use as much of our knowledge of the seed control act in educating the farmers and seedsmen of the Province of Ontario as to what is meant by the seed control act, and how it should be carried out. But it is my opinion that in some cases you are going to be up against it if you do not stand your ground; in fact, I am firmly convinced, that if I find a man trespassing upon the laws of the Seed Control Act more than I think he should, I will do what is in my power to protect the farmers of the Province of Ontario who are likely to purchase that seed.

MR. MCCREADY: Do these gentlemen in their propaganda find it difficult to make clear the distinction between Extra No. 1 and No. 1? I have the Seed Control Act embodied in that chart that I send out to the schools on Alfalfa. It seems to me that the object to be attained could be made best by possibly using some expression as Extra No. 1, Special.

MR. CLARK: I may say that we have a very great deal of correspondence with regard to the Seed Control Act and that is not a question that we are called upon to answer very often. The written definitions are as follows:

No person shall sell, or offer, expose or have in his possession for sale any seeds of timothy, alsike, red clover or alfalfa, in or from any receptacle, package, sack or bag, upon which is marked,—

(*a*) "Extra No. 1" unless such seeds are pure as to kind, clean, sound, plump, of good colour, free from the seeds of any noxious weeds, and contain not more than thirty seeds of all kinds of weeds including other useless or harmful plants per ounce of the seed so marked;

(*b*) "No. 1" unless such seeds are clean, sound, reasonably plump, of good colour, contain not more than five noxious weed seeds per ounce of timothy, red clover or alfalfa, or ten of them per ounce of alsike seed and not more than one hundred seeds of all kinds of weeds including other useless or harmful plants per ounce of the seed so marked;

PROF. ZAVITZ: I would just like to say a word or two, especially in regard to the Alfalfa. Mr. Clark mentioned that there was only about 5 per cent. of matured Alfalfa, and he did not suppose there would be more than 100 bushels in Ontario at the present time. I think probably that is true. The Alfalfa crop in Ontario last year was a failure. More so, I think I am safe in saying, than at any time in the last 20 years, owing to the peculiar weather conditions. So that there is really almost no Ontario Variegated Alfalfa seed at the present time to be obtained in the Province of Ontario. I am also very pleased at the comment Mr. Clark made that they are realizing that there is a very marked difference in the hardiness of the Alfalfa Seed obtained from different sources. We are going to try and not discriminate in regard to the Ontario seed. Better to have Ontario seed that probably is not quite as plump as compared with the very plump seed, from Utah, for instance, that produces very tender plants.

A MEMBER: Have you found any seeds in screenings that might be injurious to sheep?

MR. CLARK: No. I have spent a good deal of time at Port Arthur, watching large flocks of sheep kept in pens there, feeding on the waste refuse that is produced there and they thrive. Two carloads of lambs that I saw at Port Arthur and fol-

lowed to Toronto were marketed here and brought the best prices. There is no objection at all to the lamb or mutton from sheep that are fed on those screenings. Those screenings should be worth for sheep feed no less than bran. Sheep seem to like them, eat them, thrive on them, and when the sheep consume those seeds there are few that escape; there are some, but very few—the vitality is nearly all destroyed. It seems to me to be a shame that Ontario, boasting of being one of the very best livestock countries in North America, should let slip more than 1 1-2 million bushels of really good feed, at $6, $8 and $10 per ton, to the United States, and have the mutton actually coming back for consumption in Canada.

A Member: I suppose those weed seeds are practically all ground? Or are they fed whole?

Mr. Clark: They are feeding them to sheep principally whole, the coarser material from 50 to 60 per cent. of it is separated out, and it is ground and mixed with some grains planted with moulds of oil cake, for various oil feeds in the Eastern provinces. I would not consider any of them whole for general distribution. 50 per cent. must be screened out by use of 1-15th diameter perforation screen. The seeds that pass through 1-15th screen I think probably would do as well fed whole.

DIVISION OF LABOR ON THE FARM.

Prof. G. E. Day, O. A. C., Guelph.

I presume that many of you have been witnesses of the efforts of an unfortunate cow with not very good teeth trying to make the beginning of a particularly large round, hard turnip, and in spite of all her frantic efforts that turnip would roll over and slip from one corner of the manger to the other, and when she got through there were just possibly a few little dints and bruises on the outside of it. Prof. Zavitz handed over to me this particularly large, round, hard turnip, and I felt a great deal of sympathy with that unfortunate cow when I attempted to get something out of this question.

It is a large question, it is a hard question, and a particularly slippery question, and if it were not that the simile of the turnip applies perhaps a little better, I should be inclined to say that Prof. Zavitz had handed me a lemon.

Farming is different from almost any other kind of business, that I know, at any rate. If you take one of our very best business men and put him on a farm, a man who is unfamiliar with farm figures, but has had most excellent business training, a well trained business mind, I think that that man would discover after a few years' experience that he had to so modify and remodel and reconstruct his ideas regarding business methods that he would find difficulty in recognizing any similarity to the ideas with which he started out. It is a peculiar business, and I am not sure that we can ever apply exactly the same business rules that apply in other lines of business to this business of farming. As I said before, they require a great deal of modification in order to be adapted to the peculiar circumstances.

Farming, of course, has its strong points, and it also has its weak ones, and it seems to me that perhaps our time would be better spent in considering some of its weak points, than in considering its strong points on this particular occasion, because we are not trying at this time to induce more people to go into agriculture, but we are trying to start some of those already engaged in it, possibly thinking a little more carefully along certain lines.

There are just two of the weak points I wish to mention, and I suppose there are a great many more, but these are the two that strikes me perhaps the most forcibly. One of these is the fact that there is rather too much capital tied up in unproductive material, what we might call idle capital or capital that is idle, at any rate, for a great part of the year. The ordinary manufacturer buys expensive machinery, but he expects that machinery to work practically every working day throughout the year. The farmer has to buy machinery and a great deal of it works only a comparatively few days throughout the year, and stands under the shed the rest of the time. So it makes a very considerable difference in the lines of business, at any rate, taking the ordinary manufacturing concern and the farmer's calling, where he has to fight against that tremendous handicap, it seems as though, as time goes on, that the kinds of implements or the varieties of implements are yearly being multiplied, as if the farmer felt he could not get along without putting more and more, and more money into implements which are to stand idle for the greater part of the year. Now, that is a condition of affairs which I do not think we can get over, and hence it will be unprofitable to discuss any further. But I mention it as one of the weak points of farming, and, of course, we must leave it with every man to determine what he can get along without and what is absolutely necessary in his business.

The other weak point, and it is the point with which I am supposed to deal particularly to-day, is the irregular demand for labor throughout the year. Just in this connection, by the way, allow me to correct the title of this discussion. It should not be "Division of Labor," it should be "Distribution of Labor." Distribution of labor is the term that fits in this particular case.

In the summer months, on most farms, there is a tremendous rush of work at certain seasons, there is a great rush in seeding time, and there is another great rush in harvest time, to say nothing about other rushes that may come at other times throughout the year. And in order to get the crops in the ground at the proper time, because you all realize the importance of that, there is a tremendous demand for horse labor especially. And then later on, when it becomes a question of harvesting that crop and getting it into the barns in the best possible condition, there is another great demand, but more especially for manual labor, although not so much perhaps to-day as there used to be some years ago. Then when it comes on in the winter on a great many farms there is comparatively little demand for labor. Now, if the farmer could pick up men just when he wanted them, and the kind of men he wanted, this would not be any great disadvantage. But since in these days it is so difficult to get labor, even very moderately skilled labor in agricultural lines, it becomes very important to hold on to a man when once we get him, if we possibly can. And there is where the question of distribution of labor comes in especially.

Is there any way by means of which suitable men can be retained throughout the whole year, instead of retained for a few months in the summer and then allowed to go; because it is these men that are hired for short periods that are possibly the most unsatisfactory on the whole, and if you do get hold of a good man you hate to let him go when it comes on late in the season, in case you find that you have not profitable employment for him to follow. That is one of the great weaknesses of the farm, and if it could be eliminated to any extent, it would certainly be a very great boon to the business of farming in general.

Now, it is pretty hard to know what to say in connection with a subject of this kind, as I intimated at the start. That unfortunate cow that I spoke of, managed

at any rate to rub the dust off that turnip, cleaning it up a little, and possibly in my handling of this I may manage to rub aside a little of the dust and in some measure clear up the subject.

I have been talking with a number of progressive farmers, and they are the men to whom we must look, after all, for a great deal of advice along this line, and the whole thing seems to be summed up in a comparatively few words. Some men make a point of having all manure taken on to the fields in the winter time in an effort to distribute and equalize the labor. I may say it is a practice we are compelled to follow here ourselves. I say compelled to, because if we had to draw our manure in the summer time we simply could not do it. In some cases you find some men spreading it right on the surface and doing away with the manure spreader. I think that is an advantage.

The second point is the looking ahead. Some of the most successful farmers that I have known are men who seem to have the faculty of seeing a long way ahead, seeing things coming. That is the secret of all successful business management, as a matter of fact, it is particularly true of the farm. I think that the late William Rennie had perhaps the greatest faculty for looking ahead and anticipating what was coming, than any man I ever saw. He was certainly remarkable along that line, and it is a faculty I think that every man should aim to develop—that looking ahead for things that will be needed in the future, and having everything ready. For instance, there are some men who would forget all about the binder or something of that sort until just the day before they have to cut, and then have to make a trip to town in a very busy time to get it fixed. They must remember this, and when time is slack have it repaired. That is merely an example of the hundred and one little things that can be attended to in the winter time. Then there are the buildings and the fences, and one hardly knows what. The man who goes into this business must be looking towards that thing always,—how much he can do in the slack time to save in the busy time.

Then there is the preparation of seed grain for his own use or market. Seed grain production I believe can be made a very profitable sideline. And then last, but not least by any means, perhaps the most important of all, there is the development of the live stock end. I think it is to our live stock, after all, that we must look for furnishing profitable winter employment for the hired help or for our own help, whichever it may be. Now unfortunately, perhaps the most profitable line of livestock in the present time, does not help us out a great deal in the summertime, after all. That is the dairy cow. But still even the dairy cow can modify this to some extent. There is a little less labor perhaps in the summertime in connection with the dairy cow than in the winter. I believe that she, as a sideline, on many farms can be made very profitable along this line, in the way of offering a certain amount of employment in the winter, and requiring very, very little attention in the summer.

I think the strong point of the beef industry is the fact that the great demand made upon the farmer's time is in the winter. In the summertime the demand is comparatively slight.

Even hogs can be so arranged that they take a minimum amount of time in the summer and more time can be given in the winter.

So that it is in the livestock end of the business, after all, to which we must look for relief along this line.

Horses which are idle on many farms throughout the whole winter, can be made use of. For instance, there are some odd jobs on the farm that can be done, it

is true, without horses, but on many farms one or two of them, at any rate, can be made to produce something, by producing one or two mares. There is more or less risk about it, but all the same the man who runs no risk and who has no skill in handling them, cannot expect to make money out of it.

Now, just one or two suggestions before I conclude. It seems to me that the man who goes into the livestock business should not go into it with the preconceived notion that it requires no particular skill or ability to make a success of it. If a man is going to breed one or two mares, he should know how to handle those mares to get the best results. He should know how to handle the young colt after its arrival, so as to avoid losing him, from some of the ills which attack colts. He should also understand the feed and care of the animals. He should not expect to make a success of these things without a knowledge of the business. Why should not the farmer know how to train a colt? That is right in his line of business, and something that can be done in the winter time, too. Supposing he has raised a carriage-bred beast. Why, should he sell it in the rough to some dealer to fix up and trim up and sell it at three or four times the price that the farmer receives for it. If he is going to breed that class of horses, then I say he should learn all about that business, and not leave it for the middle men to get the profit. Why should not the farmer know how to trim a sheep? You say these are mere trifles. Well, the whole thing is a mere trifle, when you come to look at it. Now, if you go about among all these farms where there is a comparatively slack time in the winter, you will find in some cases very woeful conditions indeed. If there are any sheep they are the most unkempt looking creatures you ever saw. The cattle are very displeasing, there is nothing attractive about them to admire, and if a man comes around with the idea of buying he is not particularly attracted to them.

In the way of trimming sheep, and the keeping of horses and cattle in shape, all these things, while they look like very small matters, at the same time they are not unproductive by any means, and mean sometimes all the difference between success and failure.

It seems to me that an organization of this kind, which is specially interested in field crops, might do something in the way of planning systems of cropping which would tend possibly to distribute the labor more fully over the summer. Now, I do not know how far that is practicable, but it might be worth a little thought. Is it absolutely necessary, after all, to follow the exact line of cropping that we are following at the present time? Could certain other crops be introduced which would tend to distribute the labor a little more evenly through the summer?

Those are two points that I would like to leave with you. I can not answer them for you, because you are the only ones who can judge as to whether they are practicable under your conditions. The demands of any two farmers are not alike. What is practicable for one man is not practicable for another, and that is what makes this question so very, very difficult to deal with.

THE PRESIDENT: I am sure we have listened with a great deal of interest to Prof. Day. It may be a hard, round question to handle, but it is certainly a very live question; the farm labor question is one I think of the hardest propositions we have to deal with as farmers.

J. L. TENNANT: I do not know whether I can add very much to what Prof. Day has already told you in such an able manner. I just have in mind one farmer near me who is farming I think about 200 acres of land. He makes no specialty of any particular line, either pure bred livestock, or seed grain, and yet he manages his work so that his horses are employed during part of the time in the winter, and

also his labor. Possibly I might tell you in a few words how he arranges his time for the winter. In the first place he feeds from 20 to 25 head of fat cattle every winter, in addition to the milking cows which he keeps, which are grade Shorthorns. I think there are about 10 or 11, so that altogether he has a stock of cattle of about 30 or 40 head. His stable is so arranged that he can go right through it with a team and sleigh or waggon, and draw the manure away from the stable to the fields, where it is spread on the land. Then in addition to that he has a gasoline engine, by which he chops his own feed, even using his team in chopping his own grain and cutting his feed at home. He also grows either potatoes or turnips for sale. These he usually draws to market in the winter time, so that forms an outlet for his horse labor to a certain extent. Then he also has probably two or three young colts coming on, and in the winter time he can employ part of his time in training and breaking these ready for work or for sale, so that in these ways he keeps his labor employed during the winter time.

Another suggestion which came to my mind, which perhaps is not very closely related to the distribution of labor, but yet is an important point in farming, and one which strikes me as being a weak point in several of our farming methods at the present time, and that is the matter of keeping books. Very few farmers know how much it costs them to produce what they sell. More farmers should keep books, keep track of what it costs them to produce the stock which they are selling, and if they would do that they could cut out a great many leaks which at the present time hinder them from making the most of their farms.

J. A. Neilson: My experience has not been very large, having practically been confined to about four years in managing a farm of my own authority, and during that time my farm was not very large, but at the same time it was very necessary for me to have help, and I found considerable difficulty in getting men. Sometimes I had to pay very large wages and had to go a great distance to get men, and in that way my farm help bill was a very great deal larger than some of my neighbors who were able to employ men continuously. They gave their men continuous employment, they had houses for their men to live in, and they had less difficulty in getting men and keeping them.

I have been in the Canadian West and in New York State and Southern Ontario, and in all those places found that the men who made the greatest success were the men who had a system of farming that enabled them to keep their men continuously.

Another fact is that many farmers do not give their boys a fair chance. They look upon their sons as the hired men. I think in many cases farmers would have less difficulty if they gave their boys an interest in the farm, gave them some inducement to stay on the farm.

Hon. Nelson Monteith: The labor question is possibly the key-stone of success in farming. If we can solve that question satisfactorily to us as farmers and to those whom we engage, we have solved a great deal of the difficulty in connection with remaining on the land.

When I left this College in the year 1890 one of the first things that impressed me at that time was "How may I keep permanent help on the farm?" I made preparations then and there to erect an additional house on the farm that I might have continuous help the year round, the hired man to live in his own house, convenient to his labor on the farm. Since that time it has been my privilege to have very satisfactory help. One of my men stayed with me and gave me splendid service. It was a financial advantage to me, and to him as well. He was with me for some

twelve years. Now, the next man I had lived with me some ten years. He made his pile and retired. Now, that is pretty good for the men. The man I have now has been with me for some four or five years. I do not know whether he will retire or I will retire. However, we are getting along very well, and I find that human nature is the same the world over. If you treat a man right and do by him according to the golden rule, or as you would wish to be done by under similar circumstances, you can generally get a good response—that is, the man will return to you in good measure the advantage that you have presented to him.

Then this question of keeping men employed satisfactorily and profitably the year round; we aim as far as possible to have our dairying, stock feeding, and that kind of thing come in the winter months, and any teaming that may be necessary to do off the farm we arrange to have done during the slack season; because, as we all realize who are farming, during the summer time it requires almost every energy that you can put forth yourself, and on the part of your help as well, to look after all the details of a reasonably well managed farm. I think this point Prof. Day touched upon is well taken: instead of following possibly the beaten path in many cases of cropping we might look around and see if there is some other thing that we might not introduce to spread the labor more uniformly over the season.

Then all you who are engaged in growing corn know what a strenuous time it is about the time of cutting and silo filling. There is too much heavy labor. Now, how can we lighten that labor, is the question. By the growing of more alfalfa and utilizing that as one of our feeds. That is being brought forward in some districts as lessening the necessity of a large crop of corn.

Having satisfactory help the year round sweetens life, makes it easier for us to take pleasure out of it as we go along. That man who is compelled through circumstances to labor from morning till late at night takes very little out of life. For that reason everything that we can bring forward to solve the labor question, which is the important thing on the farm, is well taken, and I believe that on an average 100 acres reasonably well cultivated, in fact intensively cultivated, especially, there is room for the hired man's house and the garden in proximity thereto, with some fruit and all the other things that will help to sweeten life for him as well. You will find it profitable. I live near the city of Stratford, and any man who lives near a city can appreciate the proposition we are up against in getting help. It is pretty hard to keep men under conditions of that kind, unless they have a home of their own. I know it costs more now to build a house than it did when I left this College some 23 years ago, but you will find it still a good investment to build a comfortable house for your hired help on the average farm. I believe it is almost the only solution of the hired help question at the present time, and then you can arrange your business so that you can make his labor profitable through the twelve months.

Mr. Widdifield: Just in reviewing what has been said and commenting a little upon it, I might say that Mr. Monteith touched upon a very vital aspect of the situation in the matter. In fact, some of the other speakers as well spoke of the matter of distribution of labor relative to the farm crops. I think that just in that phase of the question we have a solution of the question to a great extent. If we can find employment for capital invested in the way of horses and machinery and men in the winter, it is an advantage; but if we cannot do that, and if we can work to a greater advantage with what we have in the summer, and perhaps minimize the amount of labor at any rate, I think it will be a benefit.

Now, I am becoming an enthusiast in the growing of alfalfa. I believe just in

that one crop there is a great deal for us in the matter of solving this question. We thought at the time that the growing of corn for the silo came in that that was going to distribute the labor for the year better and it did. It used to be that seeding time and harvest were the two busy times. Now we are busy all the summer through, and there is really no time for fall plowing or anything else. I don't believe we are going to go out of the corn growing business, but I believe that alfalfa is going to take the place of corn for fodder crop during the summer, as a silo crop and as a crop for storage in the barn, and I cannot conceive any argument against that prediction not working out. I believe it is going to be one of our principal crops.

This past year it was almost impossible to make hay of the alfalfa, but if we have the proper system or a proper division of the way of handling that crop it would be an advantage. I believe we are going to be able, under conditions just like we had this summer, to handle it satisfactorily, if we are ready for an emergency in every case. Of course, we cannot anticipate the weather always. We may be unfortunate in cutting a field of alfalfa just before a rain; but if we are ready for an emergency I believe that it could be put in a silo immediately, while if we have favorable weather after cutting it could be left and put in the mow.

I have been making a study of the situation, and experimenting with alfalfa and other things, and I believe it is in that one thing that the solution of the labor problem lies. I would just like to emphasize that one matter of alfalfa growing as a solution of the labor question.

GENERAL DISCUSSION ON CONVENIENCES IN THE HOME AND ON THE FARM.

Hon. Nelson Monteith, Stratford.

I have been asked to open up the discussion on this question. I am not going to take up the theoretical side of it, but just talk for a short time on farm conveniences, leaving the technical knowledge and information and figures to my good friend Prof. Day.

Farm conveniences. Where are we going to start? My own opinion is that it is a wise thing to start in the field first, and see where we can reduce possibly the fencing, so that we can increase our profits off the farm. In going through the country you will see a great deal of fencing. How much of this can be dispensed with? Or, how much of a better fencing can be used profitably?

I find in my own practice, that in the introduction of the woven fence we can enlarge our fields and in that way increase our crop production and give us an advantage in the use of larger machinery.

Now, as to the matter of water supply, I will just touch on a few things. I know that this a very superficial way of dealing with this question. There are a great many methods adopted in order that the country might have a good water supply. We have on the platform here, a hydraulic ram. After I left the College I made it my business to look into the possibilities of the hydraulic ram. I installed one, and it gave me very good service for about fourteen or fifteen years. It gave a splendid water supply for the house and barn, but I found that when I wanted to exceed my requirements, for another house on the place where my hired help lived, the supply of water I had was not sufficient, and I installed a hot air engine which has given me fairly good satisfaction, but I

believe it is not nearly so convenient as some of the powers that are now being utilized.

Now, another feature I introduced, and I have no doubt it is quite general through the country. In the approach to the barn, I excavated and built a cement tank cistern of large capacity, and the barn being somewhat higher than the house I was able to bring the rain water from the cistern at the barn and have it on tap in the house at all times. This is something within the reach of many people, and a convenience that does not cost much and you can pipe it into your yard and if you have no other water convenience, you will find it is a very handy substitute in the way of supplying water for the stock in the barn.

Now, in the matter of machinery on the farm, as another question of the conveniences that we have to have to largely consider from the viewpoint of the amount of land cultivated, whether our farms be small or large. It is a general breaking away from the 2 horsepower, that is the implements just using two horses. Since labor has become such a problem, we are beginning to find that for every man employed, we want as much horse power as can be reasonably utilized. We find throughout the country the four horses and three horses hitched to our implements, with the corresponding increase in the size of the implements used. Now, this is something that no doubt the great bulk of you have been in close touch with, and have appreciated the increase in these things. It is possibly putting labor to better advantage, but we must be careful in the use of large machinery. I know throughout the country, in some districts there is rather a tendency to slovenliness on the part of the work done on the farm. The appearance and finish of the ridges do not apparently appeal to those who have a desire to see the work well done. That is one of the dangers of the larger class of machinery, a tendency not to be just careful enough in doing your work. Now, work on the farm if it is worth doing at all, is worth doing well, and there is a satisfaction in looking at work after it is completed if properly done. You will find in many fields—and I have had opportunities of seeing personally a good deal of this Province—a great many holes and inequalities and ridging that has not apparently been properly performed, as the plowing operators have been careless in their performance. These are things that we do not want to forget in the introduction of this large machinery. Try and have the work properly performed.

Now, as to the conveniences in the buildings, possibly that is something that some of us cannot change very much on the older farms, but when we do make alterations we should keep this in view. We should have conveniences, because they mean lessening of labor and have the arranging of the work in our buildings ever in view. And to my mind that is one of the difficulties of the power situation, and utilizing it satisfactorily in Ontario. Take in the old lands, Switzerland, Denmark, and those places, where we have the utilization of electrical power in the homes and on the farms, you will find the buildings there almost contiguous to one another. Here, as a rule, you will find we have the barns removed from our dwellings, and because of that we are going to find it costly to utilize power for use in our buildings. That is one of the difficulties I see in exporting power for use on our farms.

If we can reduce the labor on the farm to a minimum through the introduction of conveniences, then we have accomplished a great deal indeed.

FARM CONVENIENCES.

Prof. W. H. Day, O.A.C., Guelph.

The subject of "Farm Conveniences" is a very broad one; one which might readily be divided, one part to be discussed by one speaker and another by another speaker, and I had thought of suggesting to the Hon. Mr. Monteith such a division. I concluded, however, that the subject would divide itself naturally, for while we both might talk on the same conveniences, we should not be at all likely to say the same things about them; and so I find it. For instance, Mr. Monteith has referred to the hydraulic ram and told what a great convenience he found it on his own farm. It is my intention, however, in speaking about the hydraulic ram to discuss its principle, cases to which it is applicable, method of installation, and the troubles that may be expected in its operation.

The Hydraulic Ram.

Here on the table we have one of these machines. You will see it consists of, first, a large dome. Beneath this dome you will observe two pipes, the large one 1½ inches in diameter. There is an opening from this large pipe into the dome, which opening is provided with a valve that opens upward into the dome. This large pipe passes through under the dome and ends in a valve known as the waste valve, which you see beside the dome. The plunger of this valve is heavy, and when the ram is not in operation the valve always remains open by reason of the weight of the plunger. The small pipe connects with an opening into the base of the dome.

When the ram is installed it must be placed below the spring. Eighteen inches fall is sufficient to operate a ram, but three feet or more is better. The fall from the spring to the ram is called the "head." The pipe which leads from the spring to the ram is called the drive pipe, which is the large pipe passing under the dome. The length of this pipe must be be at least five times as great as the head. In practice it is usually made from 30 to 40 feet long. The spring in being prepared for the ram should be fitted with a barrel, or a cement tank, or a wooden tank, and the drive pipe should pass into this tank, and should be about 10 or 12 inches below the surface of the water when the ram is in operation. The small pipe leading from the dome is called the supply pipe and should be extended from the ram to the buildings where the supply of water is required. In a climate where there is danger of severe cold these pipes should be put far enough below ground to be out of the reach of the frost, and the ram itself should be placed in a pit or shallow hole and from the pit there should be a tile drain or open ditch to carry away the waste water.

The ram being thus installed is ready for operation, and we may allow the water to come down the drive pipe. The water begins to run out the waste valve, but almost immediately the movement of the water causes a pressure on the plunger which drives it up and closes the waste valve. Up to the time that the waste valve was closed all the water in the drive pipe has been moving downward rapidly. In a ram this size which is a No. 4, the weight of water in the drive pipe is about 30 lbs. You can see that this weight of water moving rapidly must have a considerable force and when the escape is cut off at the waste valve this force deals a very heavy blow, almost like the blow of a hammer, against the valve leading into the dome. This valve immediately opens and a considerable quantity of water in the drive pipe forces its way into the dome. The air in the dome

you will see, cannot escape and consequently it is compressed by the amount of water that enters the dome. The waste valve and the pressure of the air in the dome acting against the water in the drive pipe checks its velocity. As soon as the velocity of the water is checked, the plunger of the waste valve, of course, drops down, and at the same time the valve in the dome closes, keeping in the dome any water that has entered. As soon as the waste valve is opened the water runs out as before, but as soon as the velocity is great enough the valve closes, another impulse follows and more water is driven into the dome, and this action is repeated over and over again as long as the ram is in operation. The supply pipe leading to the buildings usually empties into a tank and is left open. Consequently, air pressure in the dome drives the water up the supply pipe into the tank.

The air in the dome is an essential factor in the operation of the ram, because the air being very elastic it allows the valve to open with the sudden impulse and allows a considerable amount of water to be forced into the dome as the air is compressed. If the dome were full of water the valve wouldn't open at all, indeed, one of the chief sources of trouble with hydraulic rams in the past has been that the air in the dome would become exhausted and the ram would stop. This exhaustion of the air is easily explained for air is soluble in water. You are all familiar with this. You have all seen a tumbler of cold water set in a warm room and you have seen the little bubbles of air collect on the inside of the glass. These little bubbles came from the water, and, consequently, you know that air is soluble in water. Of course, it dissolves very slowly, and so a ram set up would have plenty of air in it to last for some months, but gradually the air would become less and less until the ram would stop. To avoid this there has been a little "snifter" valve put in the drive pipe, and this valve takes in a little air at every pulsation of the ram and the air passes up into the dome, thus replenishing the supply of each pulsation. In case any of you have rams of old style which were not supplied with the "snifter" valve, you may drill a small hole in the supply pipe about the size of a pin or maybe a little larger and you will have no more trouble with the air becoming exhausted. This, of course, seems strange to you but it is easily explained. When the waste valve closes, the valve into the dome opens so suddenly and the air in the dome compresses so easily that the water rushes in the dome fast enough to cause a suction in the drive pipe, and this suction will draw in air through the little hole or through the snifter valve.

There is another difficulty which many users of rams have had, namely, the plunger of the waste valve sticking and keeping the waste valve closed and stopping the ram. This results from the ram being set up under too great a head. Until within the last year it has been necessary to be very careful on this point when installing a ram. Recently, however, an improvement has been added which makes a given ram adjustable to various heads. Directly above the plunger of the waste valve you observe a projection on the side of the dome, and you see that the plunger strikes the bottom of this projection each time it comes up. In the bottom of it is fitted a piston held down by a spring. Each time the plunger of the waste valve comes up it hits this spring piston and the rebound of the piston will open the waste valve, even though the head is considerably greater than that for which the ram was originally made. Should it be necessary to set the ram up under a different head from that for which it is now adjusted it would only be necessary to loosen the jam-nut and raise or lower the spring piston by turning the screw in which it is fitted.

The cost of installing a No. 4 ram to deliver water at a building 200 ft. from the ram would be about as follows:

No. 4 Ram	$14.00
40 ft. 1½ in. galvanized piping at 12c.	4.80
200 ft. ½ in. galvanized piping at 5c.	10.00
Digging and filling at say 75 cents a rod	10.50
Digging pit, fitting pipe and building tank, say	10.00
Total	$49.30

Or in round numbers, say $50.

In this estimate I have used galvanized iron pipe for it costs only about 25 per cent. more than the black and will last probably twice as long or maybe longer.

The quantity of water required to operate a ram varies from 2 to 25 gallons per minute, but the ram will deliver at the building only about one-seventh to one-tenth of the amount at the spring. The rule for finding the amount of water delivered is as follows: Multiply the gals per minute at the spring by the head and take two-thirds of the product (because the ram will only deliver about two-thirds of the energy put into it), and divide by the height to which the water has to be lifted.

Thus:

Gals. per min. delivered at spring x head x two-thirds height.

For example, the No. 4 ram which we have here is suitable for a spring which supplies 8 gals. per minute. If the fall from the spring to the ram was 3 ft. and the water was to be delivered at a barn 30 ft. above the ram then:

Gals. per minute at barn=

$$\frac{8 \times 3 \times \frac{2}{3}}{20} = \frac{8}{15}$$ (which is just 1 15 of the water supplied by the spring)

Gals per day=

$$\frac{8}{15} \times 60 \times 24 = 768$$ (which equals 19 1/5 bbls.)

If, however, the buildings were only 16 ft. above the ram then this No. 4 from an 8 gal. spring would deliver 1 gal. per minute at the buildings or just ⅛ the quantity at the spring. Thus it will be seen that the hydraulic ram is only suitable where the spring furnishes from eight to fifteen times the amount of water required at the buildings.

A Member: What about the waste valve—would there be danger of it freezing up?

Prof. Day: No. Of course there has to be a waste pit, and that is continuously running, and there would be no danger of it not running away.

A Member: Would it deliver half a gallon 500 feet as well as it would 100 feet, with 32 feet of a raise?

Prof. Day: No you would have to have more water.

Water Systems for the Farm.

With the hydraulic ram and all other power methods of supplying water to the buildings a storage tank is necessary. Frequently a large wooden tank is built

upon a tower or in the top of the barn, or in the attic of the house when the house only is to be supplied from the tank. Many farmers instal a system of pipes by which the stock have water available at their mangers. Others have one or more general troughs or tanks in the yard which are always kept full and to which the stock may go for water when required. The cost of these systems will depend on how elaborate they are made. The iron piping will cost from 5 to 10 cents a foot, depending on size and whether galvanized or black. There are few up-to-date farmers but have power devices of some kind for providing the water for their stock.

It is perhaps in the house that the greatest advance at the present time is being made as to water supply and water conveniences. In very many farmers' homes throughout the country water systems are being installed, including bath, basin, closet, sink, and hot and cold water both in the bathroom and in the kitchen. We do not need to discuss the benefits and improvements of such installation. They are many and self-evident.

There are several methods of supplying the well water to the house system. In case a general tank has been erected somewhere on the premises the house supply may be drawn from this tank. If, however, there is no general tank then one must be installed in the house; or if soft water is to be used in the hot water portion of the system, a soft water tank must likewise be provided in the house. For this purpose two types of tank are used: First, a wooden or metallic tank in the attic which connects with the hot water boiler. This tank is filled by means of a pump usually placed in the cellar, and which draws from the well or the cistern depending on which kind of water is to be used. When the tank is full it provides the pressure necessary to the system. The other type is what is known as the pneumatic or air pressure tank. It is placed in the basement and is air-tight. It is connected with the well or cistern on the one side, and with the hot water tank or the cold water pipes, or both, according to requirements, on the other side. Between the tank and the well or cistern there is a force pump which may be worked either by hand or by an engine or motor of some kind. To begin with, this tank is full of air. When the pump is worked it forces water into the tank, thus compressing the air, and the air pressure thus produced supplies the force necessary to drive the water to the various parts of the system. The installation with the tank in the attic will cost in the neighbourhood of $200, and with the pneumatic tank in the basement about $300, each fitted with a hand pump. An engine to drive the pump would cost about $50 or $60 more.

A MEMBER: What becomes of the solids in the first tank?

PROF. DAY: The bacteria in the first tank destroy the solids, most of them. There will be some settle down, very little.

A MEMBER: Is it true that septic tanks can be so built that bacterial action in them will destroy the harmful materials in that tank, or injurious substances, so that when the tank is discharged it may be discharged in the open air without danger or injury to health?

PROF. DAY: If you build it on a very large scale you will get it pure enough perhaps that no injurious results will follow. It is installed in many places with pretty good results. There is no system of sewage that destroys all the injurious bacteria.

A MEMBER: Do washing fluids, or soap, or anything of that kind, have an injurious effect on the bacteria?

PROF. DAY: Oh yes, but they can all go in there, because the amount of soap is small, and it will be very diluted.

A MEMBER: What do you say about using sulphate of copper in your lavatories?

PROF. DAY: For what purpose?

A MEMBER: For destroying any bacteria there might be?

PROF. DAY: Well, it would help, but you see you would also destroy the soil bacteria out there that are purifying the last effluent. The efficiency of the septic tank system depends upon the bacterial action going on.

A MEMBER: What capacity of overhead tank would be required in case that system were used for a closet, and the other necessary conveniences?

PROF. DAY: Talking with a man yesterday who has installed a good many systems, he told me this, that in an air pressure system, installing a tank of 300 gallons capacity in the basement and pumping that up to 40 pounds of pressure, he got a delivery of something over 200 gallons of water, and 210 gallons of water would be 30 gallons of water per day for a week. Now, perhaps a barrel full of water per day would be sufficient, and so I should think that maybe a 200 to 300 gallon tank in the attic would be sufficient. 200 gallons would be 5 barrels. But if you are building a tank in the attic, unless you are cramped for room, I would not spare the size.

A MEMBER: An air tank in the basement would be found much more satisfactory.

PROF. DAY: Oh yes. And there is another thing, that with the tank in the basement you have got a pressure of about 40 pounds to the square inch, and you have got a supply of from 200 to 300 gallons, and you can have a little hose attached to that and in case of fire in any part of the house you would have a pressure which would supply enough water to put out the fire in its first stages. Now, with a tank in the attic you would not have very much pressure.

A MEMBER: Unless you had your delivery on the first floor?

PROF. DAY: Yes. But if the fire was upstairs it would counter-balance.

SEWAGE DISPOSAL.

A water system in the house necessitates some provision for sewage disposal. Two methods are in use: first, the cess-pool, secondly, the septic tank. A cess-pool consists of a large pit ranging in depth from 7 to 10 feet, and in diameter from 6 to 10 feet. This pit should be stoned up like the old fashioned well, or it may be bricked up, provided the joints are left sufficiently open to allow the sewage to pass through and soak away into the soil. Generally speaking, no outlet is provided, the liquid being allowed to soak away into the soil. From this you can see that a rather porous soil is essential to the proper working of a cess-pool. It will not prove satisfactory in heavy clay. Its cost, including connections with the house, is about $15 to $20. I have seen cases where the cess-pool has gradually saturated the soil even to the surface, producing an offensive odor and being in this case dangerous from a sanitary view-point. Sometimes the seepage from a cess-pool reaches the well, in which case the cess-pool is especially dangerous.

The septic tank system, however, is built on more advanced principles. It consists of two compartments with an overflow pipe between them, the first compartment to retain all the solids and the second compartment, being provided with a flushing valve, so that this compartment is automatically flushed out about once in 24 hours. The out-going liquid is discharged into lines of field tile laid near

the surface where soil bacteria are plentiful. These soil bacteria, together with the fresh air that enters the soil destroy the harmful bacteria contained in the sewage water, and the water itself is made use of by the grass or other plants that may be growing above the tile. Returning to the tank we have to note that for every occupant of the house we should allow three cubic feet of space in each compartment, the valve compartment not to be more than 3 ft. nor less than 2½ ft. deep. For a school or factory one-third less space will be ample. The overflow pipe between the two compartments should be fitted with an elbow and a piece of pipe sticking down part way in the first compartment. With this device it will not be possible for any solids to pass into the second compartment. Light solids will float above the opening to this pipe and heavy solids would sink to the bottom. Flushing valves are of two types; the "siphon valve," and the "valve with a mechanical trip" operated by the water as it rises. They may be purchased from manufacturers. The field tile in the distributing system should all be laid on the same level, and there should be enough of them to hold the liquid discharged from the second tank. If they were not laid on the same level then the lowest ones would receive more than their share of the sewage and the soil in that low part would become saturated and we would have the same conditions prevailing as with the cess-pool. A septic tank system, including the valve, will cost from $40 to $50.

Farm Power.

Perhaps it might be wise to note some of the different powers that may be used on the farm to elevate the water and for other purposes. Those in common use are the windmill, the hot air engine, and the gasoline engine.

Windmills: The windmill is a machine concerning which there is a good deal of misconception. Windmills are generally believed to have much more power than they really have. The power of windmills varies with the size of wheel, velocity of the wind, and the load under which they are working. The claims of manufacturers of windmills will be some indication of what power it may be expected windmills will deliver. Some American manufacturers publish a table showing what amount of water windmills will pump to various heights with a 16 mile wind, which is about an average or moderate wind. In a 16 mile wind an 8 ft. wheel pumping water 25 ft. high will raise 848 U.S. gals. per hr. which means nine one-hundredths of a horse power or a shade less than one-tenth. The same mill pumping to a height of 150 ft. will deliver 212 gals. per hr., which requires .136 of a horse power which is a shade less than one-seventh of a horse power. With the same wind a 20 ft. wheel will develop from ½ to 9/10 of a horse power. These are manufacturers' figures, so we can see that in a moderate wind windmills give only a small amount of power. If, however, the wind increases in velocity, thus, if the wind rose from 16 to 32 miles an hour, that is doubled in velocity, the power would be increased to 2 x 2 x 2=8 times the former amounts. Thus, with a 32 mile wind an 8 ft. wheel would deliver from ¾ of a horse power to 1 1/10, and a 20 ft. wheel would deliver from 4 to 7½ h p. It is only on the very windiest day that the wind blows faster than 32 miles per hour.

Of course, the power derived from the wind costs nothing but the interest on the price of the windmill which is very small. The chief objection to the windmill is that the power is intermittent, and frequently there is no wind at the very time that power is wanted most. Besides lightning frequently strikes windmills and, consequently, they are dangerous unless properly grounded, and in the heavy gales of recent years many windmills have been blown down. Because of these unsatisfactory features of the windmill it is being displaced by other motive powers.

HOT-AIR ENGINES: Some people use what is known as a "hot-air" engine for such light work as pumping water, turning separator, washing, churning, etc. These engines are very simple, may be had for any kind of fuel, and give practically no trouble in operation. They work on the principle that air when hot expands and when cooled contracts. The cylinder of a hot-air engine first passes into the flame produced by the fuel, when the air in the cylinder becoming heated expands and drives the cylinder towards the other end of its stroke where it is surrounded by a jacket containing cold water. This cools the air, causing it to contract and the piston is driven again to the flame where it once more becomes heated and expands, etc. The hot air engine is not made in units larger than about 4 h.p., as its principle is not suitable to larger sizes. It is heavy for the amount of power which it delivers.

GASOLINE ENGINES: In recent years gasoline engines have become much more reliable than formerly and are being widely adopted by the farmers throughout the country. They are of two types: First, the four cycle; secondly, the two cycle. A cycle is the movement of the piston from one end of its stroke to the other. There are two cycles in each revolution of the balance wheel, in other words, the cycle is a half revolution. Four operations occur in the working of a gasoline engine: First, the explosion, that is when the gasoline in the cylinder is fired by the electricity it explodes and the explosion of the gases drives the piston forward. Secondly, exhausting. The burned gases remaining in the cylinder after the explosion must be expelled before another explosion can occur. Thirdly, admission of a fresh supply of gasoline and air to the cylinder. Fourthly, the gasoline and air must be compressed in order that it will fire well and cause violent explosion. Now, the cylinder of the four-cycle engine is open at one end and the piston may be seen as it moves in and out of the cylinder. The connecting rod and the crank shaft are also visible in the four-cycle engine. A full cycle is allowed for each of these operations, and they take place in the order just given. Consequently, an explosion occurs every fourth cycle, that is one explosion in two revolutions.

The two-cycle engine, however, is constructed differently. You cannot see its piston, connecting rod or crank shaft, the base of the engine being closed, and air-tight, except what leak there may be at the bearings of the crank shaft, and they are as air-tight as possible, hard cup grease being forced in for this purpose. In this engine two operations take place in each cycle or half revolution. When the explosion occurs, driving the piston forward, the piston compresses the gasoline and air in the base, and as the piston comes back the compressed gasoline and air are admitted into the cylinder, the exhaust or burnt out gases being allowed to escape at the other end of the cylinder. During this same cycle, fresh gasoline and air are taken into the base and the engine is ready for another explosion. Thus, in this type it just requires two cycles for the four operations, and thus the two-cycle engine gets an explosion for every revolution.

From the fact that the two-cycle engine gets twice as many explosions as the four-cycle it might be thought that this engine would deliver twice as much power in the same time. This, however, is not found to be the case: as a matter of fact, the two-cycle delivers about 14 per cent. less power than the four-cycle. This is explained by the fact that all the burned out gases are not expelled, and, consequently, the fresh gasoline and air with these impurities make a weaker mixture and the explosion is less violent than in the four-cycle.

However, although the two-cycle is not so economical as the four-cycle it has a decided advantage in another direction. Since it gets an explosion once every

revolution it does not require such heavy balance wheels to keep it running between explosions, and, consequently, it does not require such a heavy frame and base to support the balance wheels. Thus the two-cycle is a very much lighter engine than the four-cycle, and hence it may be more easily moved about from place to place, and portability is a desirable feature in a farm engine.

But you ask "Can we afford to use the two cycle when it uses 14 per cent. more fuel than the four-cycle?" My answer is "Yes," because it will not make more than two or three dollars difference in your gasoline bill for the whole year, and it will often be worth that much to have a light engine that you could move from one job to another quickly and easily. It is easy to substantiate this statement by estimating the amount of power required on the average farm and the gasoline necessary to produce that power.

QUESTION: Can anyone tell me how much grain the average farmer will grind in a year?

MR. ALBRIGHT: Say 1,500 bus.

MR. MONTEITH: About 1,000 bus.

PROF. DAY: Well I am going to allow enough power to grind from 2,000-2,500 bus. I consider this practically the maximum that will be needed on the farm, because the figures were given me by a man whose farm consisted of 320 acres, who had a stable 56 x 76 filled with horses and cattle, another stable for sheep, and another for pigs, and the grain consumed by all the stock amounted to from 2,000-2,500 bus. per annum. Now, with a 3 h.p. engine it will take 20 days of 10 hrs. each to grind that amount of grain, thus we may estimate the power requirements on the farm somewhat as follows:

Grinding—2,000-2,500 bus., 3 h.p., 20 days.

Pumping—1 h.p., ½ hr. per day. This will pump 2,500 gals. or 62½ bbls. from a well 40 ft. deep or 125 bbls. from a well 20 ft. deep.

Cutting—3 h.p., 3 days of 10 hrs. each.

Pulping—½ h.p. 1 hr. per day for six months.

Washing—1/6 h.p. 6 hrs. per week.

Sawing—3 h.p. 1 day.

Separating—1/6 h.p. ½hr. per day.

Churning—1/6 h.p. 1½ hrs. per week.

And what does all that amount to? It just amounts to 3 h.p. 1 hr. per day or 1 h.p. 3 hrs. per day, and the gasoline for that amount of power at 20 cents a gallon will cost just $27; 14 per cent. of that is $3.78. Therefore, on the largest farm the difference in fuel consumption between a two-cycle and a four-cycle amounts to less than $4, and on the average farm it would not amount to more than $2 or $3; consequently, if I were buying an engine for farm purposes I would buy a two-cycle, which would give me a light engine that could be easily moved from place to place.

There are many cases on record where gasoline engines have been very troublesome, but after running six or seven different kinds I have come to the conclusion that if a gasoline engine does not work it is not the engine's fault. This has been strongly brought out in my own experience. I obtained my first knowledge of a gasoline engine some years ago when my brother and I rented a gasoline launch for a couple of weeks. In that time we had about five or six days satisfactory use of the boat, the rest of the time we were having engine trouble. During that time everything conceivable and several things inconceivable went wrong. A couple of years later, however, I purchased a small launch whose engine was considered absolutely useless, and the boat was nicknamed "The Dead Fish." However, I

put her in shape, and she has never "bucked" five minutes since that time. The chief trouble with gasoline engines is ignorance on the part of those attempting to run them. Suppose we were to take one dozen steam engines and put them in charge of a dozen men who had absolutely no training with the steam engine, not only would they put the engine out of commission but probably not one of them would be left to tell the tale. The gasoline engine, however, is much simpler; nothing very serious can go wrong with it even in the hands of an inexperienced operator, and after trying a few times to run it without gasoline, or with his batteries run down, or with the switch not turned on, or without water to keep the engine cool, he gets the necessary instruction by his experience, and finds himself able to run the engine continuously without serious difficulty.

The subject of "Farm Conveniences" is a very broad one; however, as my time is exhausted I shall have to conclude by thanking you for your kind attention.

A MEMBER: Which engine would be most apt to last the longest?

PROF. DAY: I believe the 4-cycle would last longer than the 2-cycle, but I do not think that at one hour a day any of you would be troubled with your engine giving out, providing you used it right.

A MEMBER: If you had only one engine what horse power would you buy?

PROF. DAY: If I had only one engine I would buy a 4½ h.p., but I would not buy just one, I would buy an 8 h.p. and a 2 h.p., or somewhere in that neighbourhood.

A MEMBER: How does 8 do for silo filling?

PROF. DAY: It will just take it its full capacity to fill silos.

A MEMBER: Very slow?

PROF. DAY: Yes.

POSSIBILITIES OF INTENSIVE FARMING IN ONTARIO.

J. W. CLARK, CAINSVILLE.

When Mr. Zavitz wrote me and asked me to come here and speak to you on this subject I was undecided whether to come, or not. My name has already appeared in a number of the newspapers as an authority on intensive farming, and I have been almost flooded with enquiries from different people wanting to know my methods of farming.

I have had a good deal of experience not only in intensive farming, but also in extensive farming, as I farmed a two hundred acre farm for ten years. I was fairly successful in farming the two hundred acre farm, and my time was pretty well monopolized in looking after all that land. I came to the conclusion that I was undertaking too much, as I was keeping some bees and poultry as well. When I commenced dabbling in poultry I did not know very much about it. It was only after Prof. Robertson returned from the Old Country and told us that we had a good market there if we would but fatten our chickens, that I really became interested in the subject. I started with four hundred chickens, and found that after two weeks they did not weigh as much as when I commenced with them. I found there was something wrong, and had to change my plan of feeding. That same year I was at the Winter Fair, and took the best sweepstakes in the show.

I gave Professors Grindell, and Hurtsenblen, who went over to England a few years ago, one hundred and fifty dollars, and told them to buy me what they considered to be the most saleable type of bird in England. I was flooded with orders for

this stock, and saw at once the possibilities there were in the poultry business. I said to my wife, there is more money to be made along this line with far less labor than there is in working a two hundred acre farm, so I sold out. I did not want to keep poultry alone, and thought other things ought to go with it, so I obtained thirty colonies of bees. Then I got an idea that I should get a good orchard where I could grow fruit, have a run for the chickens, and keep the bees in one corner of the orchard. I did not know much about growing fruit at that time, and obtained a good deal of my information through reading papers, bulletins, etc.

The place that I bought had about five acres of apple trees on it, as well as some other small fruit. The orchard had been neglected for a good many years, not having been cultivated for ten or fifteen years, probably longer. It had not been sprayed or properly pruned. I found it considerable labor to get the orchard in an ideal condition for producing fruit. In about three years' time I began to obtain results. The man who had previously owned the place told me that the best yield he had ever obtained was one hundred and fifty barrels of apples from the orchard, many of them being inferior apples. Four years ago that orchard yielded three hundred barrels, the next year four hundred and fifty, and the year following five hundred, and last year I had five hundred and fifty barrels, and this year I had nine hundred barrels. It is hard to believe the contrast in an orchard that is well cared for, and one that is not. This is an instance of what proper care and good treatment will do for an orchard.

Last year I had altogether about twenty-five acres of land which, with poultry, bees, and fruit, returned me a little over five thousand dollars. This year, the returns have been about the same, but expenses were somewhat higher. The nine hundred barrels of apples mentioned previously, were all packed by myself, and sold, and averaged me about $2.50 per barrel. These were Spies and Kings largely, with a few Greenings. We have a small Fruit Growers' Association, of which I am Manager, and we sold them all to one man. This amounted to $2,250. The barrels cost me $387, picking and packing, $225, making a total of $612. This leaves a net profit from the five acres of $1,638. Of course, there was some expense incurred in pruning and in fertilizing the orchard, but the amount was small.

Most of the money I have made from poultry has been in keeping pure-bred stock, and in selling it at fancy prices. The receipts last year from this source was as follows: Breeding stock, $1,800; culled stock which was killed, $75; eggs for hatching, $650; eggs marketed out of season, $75; making a total of $2,600.

I had altogether last year forty-three colonies of bees which I kept on that five acres. This was spring count. I do not know exactly how much honey was produced, as the neighbors kept getting small amounts from time to time. I suppose I sold between four hundred and five hundred pounds. Besides this, I sold to one man three thousand pounds. He furnished the tins, and paid me eleven cents f. o. b., which amounted to $330. I have between one hundred and fifty and two hundred and fifty pounds left yet.

In speaking of the smaller fruits, I realized seventy dollars for pears, eighty-four dollars for grapes, seventy-five dollars for strawberries, and for plums, twenty-seven dollars. In addition to these amounts I received thirty-five dollars for some early apples, and sixty-three dollars for tomatoes. I am dropping the strawberries, because they require too much attention at the time when I am busy with the bees. One other crop which I omitted to mention was raspberries. I received altogether from my raspberry patch this year eighty-five dollars. These several crops make up a total of five thousand and eighty-five dollars, produced off the twenty-five acres, the bulk of which was from five acres.

Now, you will naturally want to know how much my expenses were for hired help. This was probably less than you suppose, because I have had a number of people come to me for experience in intensive farming. I have had no trouble in getting men for two hundred dollars per year.

A MEMBER: What time do you prune your orchard?

MR. CLARK: I had a man pruning this year in March, and from that time up to June. I think, probably, June is one of the best months for pruning if the work can all be done in a short time.

A MEMBER: Do you require an expert in that work?

MR. CLARK: Yes, it requires an expert to do pruning properly.

A MEMBER: Is the price mentioned just for the fruit?

MR. CLARK: That is f. o. b., barrels, and everything.

A MEMBER: Did that five acres produce the feed for the chickens, as well as furnish the crop of apples?

MR. CLARK: No, I am talking of the receipts from the five acres of apples and poultry. I had the other part of the place on which to raise the feed.

A MEMBER: Where do you get your hired help, from country places or from towns?

MR. CLARK: Mostly from country places. I like to get a man that is brought up on the farm.

A MEMBER: Do you prefer chemical fertilizers for your orchard?

MR. CLARK: Yes, I am a great believer in artificial fertilizers. I use potash and ground bone. Of course, you want to combine manure with it. I think a light application of manure, potash and phosphoric acid very good.

A MEMBER: What cultivation do you give your orchard?

MR. CLARK: I cultivate from the time I can get on the land until the middle of July every year.

A MEMBER: Do you grow any cover crop?

MR. CLARK: Yes, I have sown buckwheat, lucerne, vetches, and rye. I like buckwheat the best, as it comes up between the trees where it is not shaded too much, and affords feed for the chickens. It seems to grow more rapidly than any other cover crop which I have tried.

A MEMBER: Did you ever try rape?

MR. CLARK: No.

A MEMBER: Do you plow in the fall or in the spring?

MR. CLARK: I usually plow in the spring, but I do not think this would make very much difference.

A MEMBER: Do you keep a horse, and a cow or two?

MR. CLARK: Yes, I have three head of cattle, and two horses, I raise some corn, and enough hay and oats for the horses.

A MEMBER: What do you consider the net return from your whole farm, after all expenses are deducted?

MR. CLARK: I should say about $3,500.

A MEMBER: Is this from twenty-five acres?

MR. CLARK: Yes, I am quite certain in saying that, because there are a number of things which I have sold off the place and have not mentioned, Cherries for instance. I suppose I sold about fifty baskets of cherries.

A MEMBER: Have you had your living in the way of vegetables as well?

MR. CLARK: Yes, we grow all our own vegetables. I have a family of seven children (applause), and usually have two hired men.

A MEMBER: What proportions of potash and phosphoric acid do you use in fertilizing?

MR. CLARK: I use about half and half.

A MEMBER: How much do you apply to the acre?

MR. CLARK: About three hundred pounds of the mixture. Last year I sowed it separately. I have used both the sulphate of potash, and the muriate of potash. I think the muriate of potash is the better of the two, and it is easier applied.

A MEMBER: What is your soil?

MR. CLARK: It is a sandy loam. I have set out a large orchard of plums, pears, apples and cherries, and from that twenty-five acres I expect in eight or ten years to produce ten thousand dollars.

A MEMBER: Do you apply the fertilizer every year?

MR. CLARK: Yes, every year.

A MEMBER: Do you cultivate the fertilizer into the ground?

MR. CLARK: Yes, I sow it on top, and cultivate it in.

A MEMBER: How often do you spray in the season?

MR. CLARK: I spray twice. In this new orchard I sprayed three times this year. Many people who are spraying do not spray thoroughly. If the spraying is properly done twice in the season should be enough.

A MEMBER: Did you have any scab this year?

MR. CLARK: I had a little in one end of my orchard, where the greenings were planted too closely. This was on the underside of the branches where it was shaded, and the water did not dry off.

A MEMBER: Did you have any ink spots?

MR. CLARK: Very, very little. I do not think I had one per cent. this year. This is treated by thinning out the wood, and letting the tree dry.

A MEMBER: What time would you spray?

MR. CLARK: When the tree is not in blossom. I claim that my bees help my fruit trees a lot in fertilizing. I believe every man who has a large orchard should keep bees.

A MEMBER: How many chickens do you keep in a colony house?

MR. CLARK: About seventy-five when they are growing, probably fifty in the fall.

A MEMBER: What are the size of your colony houses?

MR. CLARK: About the size of a piano box.

A MEMBER: Do you remove the chickens when the apples come to anything near maturity?

MR. CLARK: No, I do not believe there is one per cent. of the apples that are injured by the chickens.

A MEMBER: Have you any estimate on the number of trees that one colony of bees will fertilize?

MR. CLARK: That would depend on the weather I should think.

A MEMBER: What is your principal market for your fruit?

MR. CLARK: The Northwest. Most of my poultry went to the United States.

F. W. KROUSE—What little I will say is regarding the experience I have had. When I started out in this intensive farming I was a laboring man, hired out, and I gave it up to go on one acre of land. A lot of people laughed at me and said it would not pay. I made enough to keep myself and my wife off the one acre for the first year, all right. Off that one acre, without any preparation at all, I took $425, besides keeping the house in vegetables. I thought that very good for a start, and I bought another one and a half acres, and I then made $1,600. I had no bees the first year. The third year I had some bees, 11 colonies, I think it was. The next year I had con-

siderably more bees, I bought some and I had some of my own, and I made $2,750 off 2 1-2 acres, with bees, poultry and small fruit, with our living. I did all this work myself, so I had no expense for labor. Of course, fertilizers cost me considerable, but labor cost me only my own. Then, I thought when I had done so well on 2 1-2 acres it would be a good plan to buy more land, and I bought 7 1-2 acres more alongside of it, and much better land, but since I got more land I have not done so well accordingly. Perhaps there are reasons for that. I have always tried to do the work myself, and it is too much. You can't work ten acres of land and do it properly, to get all you should get out of it. I could not estimate to you what I have made off those ten acres.

Then as to the different ways in which I made my money. Mr. Clark puts fruit and poultry first, I notice. Well, I put it the other way. I put bees first and poultry last. I started out the other way though, I started with poultry, not bees, but I gradually gave up the poultry.

From our bees this year, we had 100 colonies in the spring, and we got 11,000 pounds of light honey and 2,000 pounds of dark honey, and increased by 80 colonies. We sold all our honey on the market here:—

Light honey, 15 cents a lb., $1,600; dark honey, 8 1-2 cents a lb. $178; 80 colonies of bees at $3 each, $240; we have a large asparagus bed. We are only cutting from 2,000 roots, it isn't half an acre, $200; potatoes, 400 bags, we haven't marketed these yet. Currants and Cherries, $50.

Now, our cherries are just starting to bear. There is only about a dozen trees bearing. We have 135 trees on this small piece of land.

And from the poultry, after paying for feed, etc., we realized $250. Now, that amounts to a little over $3,000, nearly all of which comes off the 2 1-2 acres. Our other 7 1-2 acres have not produced very much. Of course, it is just as Mr. Clark says, in a number of years it will be better, it has not reached the stage to produce as yet, but I think myself that I have too much land. Mr. Clark is buying more. I am willing to sell half of mine, and I think I can do better on the half and not hire help. I don't know, I may be a little cranky about hired help, but I can not get anybody to suit me. I would rather do it myself. I have a boy to look after the chores around the place, but no experienced help whatever.

A MEMBER: Do you do all that work between seven and six?

MR. KROUSE: No, I do not. I am a busy man in the summer.

A MEMBER: What will be your average hours?

MR. KROUSE: Well, from daylight in the morning till sometimes, in the very busy time in the honey flow, I have worked all night. It is only in the honey flow that I did that. It does not last very long. But usually from daylight till dark.

A MEMBER: The hours are short when you enjoy the work, are they not?

MR. KROUSE: I enjoy the work, and I never think of it being laborious at all. So far I am never tired, I could go right on working.

A MEMBER: You lie up all Winter then, I suppose?

MR. KROUSE: Well, not always. I go out on the road in the winter dealing in raw furs, but this winter I am staying at home, taking a rest.

A MEMBER: What did you say your total receipts were?

MR. KROUSE: I think it is a little over $3,000, but I cannot figure the potatoes in. I am expecting $2 a bag for the potatoes. In fact most of them are sold already at that price.

A MEMBER: You haven't many small fruits?

MR. KROUSE: When I started I had strawberries. I gave that up. I found it was too much work and too hard to get labor to get it harvested. Of course, our as-

paragus is up now, and in place of 3,000 roots another year we will have 25,000 roots to cut from.

A MEMBER: What kind of soil is your asparagus on?

MR. KROUSE: Gravel bottom, with good deep soil with a kind of heavy loam, not a black loam, but between a clay and a sand.

A MEMBER: If you had to give everything up but one line, which line would you keep?

MR. KROUSE: I would keep the bees. I will tell you my reasons for that—I think you can make your money much easier than you can out of any of the others. You are not busy so long in the year. With poultry you have your work the year right through, and with gardening in the summer you are never done and you do not get so much for your labor. Of course, you have your bad years with the bees, but as a general thing they give you a very fair living. If you have your bees in good condition when the honey flow comes, if there is any honey you will get a fair surplus. I have always been able to get a fair crop of honey. Of course, I have not had as much time with the bees in former years as I have had this year, and I think perhaps with even more I could have done a good deal better than I have this year.

A MEMBER: Is your asparagus sold locally or sent away?

MR. KROUSE: So far we have sold it locally, but I expect when I cut from the 25,000 roots I will have to ship some out, because a good many others have started in the same line.

A MEMBER: Supposing your neighbor had colonies of bees next you, would yours rob the others?

MR. KROUSE: Not necessarily, if they were kept in good condition. Of course, if they got weak then they might rob them. But three colonies are just as liable to come and rob from 100 as the 100 are to come and rob from the three. If the 100 get started they would clean out the three much quicker. You want to keep them in good condition by giving them plenty of food.

A MEMBER: How many of a family have you?

MR. KROUSE: Three.

A MEMBER: Do they all work on the farm?

MR. KROUSE: No, they are not old enough yet.

A MEMBER: What do you use for packing?

MR. KROUSE: I have been using chaff and shavings. I prefer the chaff if you can get it. It has one objection—it usually has some grain in it, and mice get at it. My experience with sawdust is, that it cakes and gets solid and does not keep out the frost.

A MEMBER: What kind of a hive do you use?

MR. KROUSE: 10-frame Langstroth.

A MEMBER: Are your hives clear of the ground?

MR. KROUSE: The bottom of the stand makes the bottom of the hive, and it stands on a 2 x 4 scantling with a brick under each corner.

A MEMBER: Do you extract all your honey?

MR. KROUSE: Yes.

G. A. ROBERTSON: Now, I do not know that I will try to keep up to the reputation of the two former speakers, simply because I do not want to get my name in print. I have 70 acres near the town, and am not in the sub-division business. I have had agents this last month or two asking me to sell some land. I had a fellow come and ask, "How much would you take for ten acres of land?" I told him it was not for sale. He said "How much is it worth?" "Well," I said "it would depend a

good deal on the land." "What do you mean?" he asked. "Well," I said, "there is asparagus there which after paying working expenses, fertilizers, etc., and that one acre is worth $300 each year, and 6 per cent. on a valuation of $5,000."

I have been growing cherries, too. That is something that the other speakers touched on. I have had good and bad trees. The good trees have yielded, that is average trees, from two to three thousand dollars worth of fruit in one year. But that is the wrong way to figure it. I am at present engaged in trying to extend my fruit plantation so as not to increase the yield of the larger trees, but increase the extent of my orchard and improve all the trees in it. It is my object to make a living in fruit growing. I am in the business because I like it. My intention in starting fruit growing is to make the poor trees come nearer the yield of the better trees. I am not going to figure up what the profits or the losses will be, etc. But I have had very good crops for the last few years. That comes from getting the right kind of land, fertilizing, spraying and pruning, cultivating, and harvesting properly and at the right time.

I do not agree to the remark of Mr. Clark's about his labor, because I had an acquaintance of mine in town who said he had a couple of good, husky boys, and was anxious to get his boys out on the farm. But I said no. I go the other way, of trying to get the men who know how. I know that they know how, and try and hire them and keep them by the year. And I hope in the future, as my yields increase, to run the thing so that I will be able to look after the directing of it, rather than doing the work myself.

I have been often asked the question, "What is there the most money in?" Well, I do not know. I think that if anyone makes a specialty of any crop as the ideal crop, and knows how to grow it right, there is a good living in growing almost anything in the fruit line, poultry line, or stock line. But you have to have the right kind of soil, and so on.

The reason I have 70 acres is, that part of my land is yielding, and yielding very well, so I thought as an investment I would get some money, and get some run-down land and underdrain it and cultivate it. I have been planting pears and cherries, this past few years, because there has not been a great many cherries. I have also been increasing the acreage of asparagus and putting in peaches.

Geo. W. Putman: In regard to the profits that the farmers in our district are making out of their alfalfa fields, I might say that Silverdale is in the heart of the variegated alfalfa section, and located about the centre of the Niagara Peninsula. About thirty years ago or upwards a Dr. Culver of Wellandport and a Mr. Bethel each imported a small quantity of alfalfa seed from Germany which they sowed on their farms, Dr. Culver giving a few pounds of his to three or four different neighbors, and it is possible that from those two sources we have our variegated alfalfa fields in that section to-day.

I might say that the increase has been very gradual. One farmer would see his neighbor getting two or three crops a year to his one, and would naturally be induced to try some of it, and to this day it has gradually spread until to-day we have scores of fields throughout that section.

I will give you just two or three instances that will possibly give you an idea of what these fields will do under ordinary conditions. Our land is nothing extra down there; it is hard clay land, most of it.

Mr. ——— has a 12 acre field, 4 years old; it cut in 1912 the first cutting 25 tons and the second cutting 7 tons, or a total of 32 tons. Now, there is a creek runs

through that field and some flat land that the alfalfa is killed out on, so that that is hardly a fair estimate of what it would produce under ordinary circumstances.

Then Mr. George Winter, of St. Anne's, has nine acres that has been seeded for 5 years. I might say that I visited that field with Mr. Southworth, of the College here, when it was in the first bloom, and it was certainly a beautiful field. In the first year that he cut that, 1910, the first cutting yielded 12 loads—Mr. Winter averaged his loads at about a ton of cured hay—the first cut produced 12 loads and the second cutting 9 loads, or a total of 21 loads. The next year, 1911, the first cutting realized 15 loads, and the second cutting 10 loads, or a total of 25 loads. Besides that he pastured 12 head of cattle for six weeks and he left a good mulch on the ground for the Winter. Now 1912, this year, of course, was a very favorable year for hay, being a wet season. From the first cutting he got 23 loads, and the second cutting 7 loads, and the third cutting 8 loads, or a total of 38 loads, off that 9 acres.

Now, the land through that section where that field is, is not considered valuable. I think you could buy a farm there for possibly fifty dollars an acre. At that price the land that alfalfa grew on would be valued at $450. Now, the 38 loads that the field produced this year at $15 a ton would come to $570, or $120 over the value of that land this year. I would not say that field could be bought for $50 an acre, because Mr. Winter told me that he valued that land at $100 an acre. Now, that field has produced for the three years 84 loads of hay, and at $12 a ton that would bring over $1,000. Of course, I know that is nothing to what can be done on that land, but still I am showing you what can be done on land of that value.

Mr. ——— has six acres. This field is fifteen years old. The best yield was nine years ago, when he got in the first cutting 24 loads and the second cuttnig 6 loads, beside pasturing 8 cows for one month. In 1911 he cut 15 loads the first cutting, and the second cutting produced 12 bushel of seed. Now, that seed would be worth around $150. He did not make a third cutting; as the fall was not favorable, and anyway after a crop of seed is taken off, you never get the third cutting of alfalfa. In 1912, this year, he plowed up about an acre of that land. Mr. ——— said he never grew a better crop of potatoes on his farm than grew on that alfalfa ground, and on the 5 acres which was left he cut 12 loads the first cutting and 2 loads the second cutting, besides some pasture off it. This is after fifteen years seeding.

Mr. ——— has a field part of which is 14 years old and part 16. For the 15 acres it has averaged for the last two years, the first cutting about 2 tons of hay to the acre and the second cutting about 1½, and the third cutting about ¾ of a ton, or a total of about 4¼ tons per acre for the last two seasons. I might say that last year we paid him $212 for the seed off the second cutting and besides he kept some for using himself, and for a neighbor or two, possibly two or three bushels. I would like you to consider the value of the field that has been seeded for fifteen or sixteen years, and during all those years has had no fertilizer or no manure applied, and at the end of that time it is in better condition possibly than when he started with it.

There are all over the province clay belts that are admirably suited for alfalfa growing, which to-day are not considered very valuable, and I believe when the farmers wake up to the possibilities that are presented in alfalfa growing that those lands will treble in value. When that comes to pass we will have "A land flowing with milk and honey," and with abundance of fruit Ontario should be the garden of the world.

Prof. C. A. Zavitz: I think we have had a most profitable discussion. Last year I was down in the State of Ohio and I heard Professor Warren of Cornell University give a splendid address. I thought "There is a grand man for our

Experimental Union meetings." We had him here last year and thought a great deal of him. He gave us the results of some work they are carrying on in New York State, where they go from one farm to another, studying the conditions there, and what the farmers are making. They found there from the observations they made, farming in the ordinary way, that farms of about 150 to 200 acres in size were giving better profits than the smaller ones, and I think that that is all right under the conditions of farming in the ordinary way, using the large machines, and so on. But remember, that is farming in just the way they are farming there.

Well then, we thought that perhaps it was not right just to leave it in that way; for that is the best sort of farming, and we knew that there were some men who were doing splendidly in Ontario. I believe we are going to have right here in Ontario a great change in connection with our crop production. It is not only those farms that are having fruit and honey and poultry that are giving good results, other farms as well. I don't know but what it would be a good plan next year to bring out in connection with our Experimental Union more intensive farming in connection with corn and things of that kind.

A MEMBER: I have farmed only some five years, and I have started in with sweet clover, and I think that there are possibilities in the old fashioned sweet clover that people don't realize. I have now about 10 acres. We grow beans, as well.

POTATO CANKER.

PROF. J. E. HOWITT, O.A.C., GUELPH.

I do not come here as an authority on Potato Canker for, fortunately in this country up to the present time, we have not had this disease: but we are threatened with it, and forewarned is to be forearmed. Therefore, I wish to tell you something about it, and about what is being done in this country to prevent its introduction and spread.

The Botanical Department at Ottawa, and we here at the College, have been warning the people throughout Canada about this disease. Bulletins have been issued and notices inserted in the agricultural papers warning farmers to beware of planting potatoes infected with Canker. Careful inspections of imported seed potatoes from England and Europe have been made. In spite of these precautions there is reason to fear that Potato Canker has been introduced into Canada. In 1911, as you are aware, there was a great shortage in the potato crop. The consequence was that in the spring of 1912 large quantities of potatoes were imported from England. These potatoes were carefully inspected, and about the end of April a shipment was discovered containing Potato Canker. Immediately the Dominion Government prohibited the introducton and sale for seeding purposes of potatoes imported from Europe. Now it is exceedingly hard to enforce such prohibitory measures, and it is, therefore, reasonably safe to say that considerable quantities of English and Scotch seed potatoes were used in Canada during the spring of 1912. It is, therefore, very probable that Potato Canker is now in Ontario, and I shall therefore endeavor to make clear to you the nature and symptoms of Potato Canker in order that you may recognize the disease when you see it.

THE NATURE OF CANKER: Potato Canker is a fungus disease. It was first discovered in Hungary in 1896. In 1901 it was first noticed in England. In

1908, two hundred and forty-four cases were reported to the authorities in England. In 1909 it was discovered in Newfoundland. Potato Canker is now found over the greater part of Europe. It is introduced into new countries solely through planting infected tubers. Once the soil becomes infected it remains so for a period of at least eight years. No remedies have yet been discovered that will prevent the appearance of the disease if infected tubers are used for seed. Those who have studied the disease in England state that there are some fields so badly infected that it is impossible to grow sound potatoes upon them.

THE SYMPTOMS OF CANKER: Canker does not attack to any extent the stems above the ground and it is not until the tubers are dug that the disease is noticed. Canker in the advanced stage is easily recognized. The badly diseased tubers are misshapen and do not in the least resemble potatoes, being simply irregular lumps of warty excrescences. Tubers which are only slightly affected, at first sight appear quite sound. The presence of disease, however, may be detected by examining the eyes, which will be found to be slightly protruding, rusty in colour and composed of clusters of little nodules. No man would plant the badly diseased potatoes but those showing the first symptoms of disease might easily be overlooked and planted.

PREVENTION OF POTATO CANKER: The remedial measures that are recommended are: The destruction of the diseased crop; treating the land with unslaked lime at the rate of four or five tons per acre; replacing potatoes in a four year rotation by some other crop. These remedial measures are costly and difficult to apply. In prevention, therefore, lies our chief hope of escaping loss from Potato Canker. Potato growers should examine carefully all tubers used for seed and should ascertain with certainty the source of any seed potatoes they may require to buy. The Dominion Government has prohibited the importation of European potatoes, but as the disease may already be in the country too much care cannot be exercised in looking for it in order that if it is in the country, it may be found and prevented from becoming established. On no account should potatoes showing the slightest evidence of Canker be planted. Samples of the suspected tubers should be sent to Mr. H. T. Gussow, Botanist, Dominion Experimental Farm, Ottawa, or to the Botanical Department, O. A. C., Guelph, for examination and report, and no risk should be taken by planting them before a report upon them has been received.

A MEMBER: Does it make any difference in the stalk?

PROF. HOWITT: It is very seldom that there is any sign of the disease on the stem of the potato. It is not until you dig the potatoes that the disease is discovered.

A MEMBER: Are those potatoes fit to eat?

PROF. HOWITT: Those potatoes that are only slightly diseased are quite fit to eat. There is, however, some danger of the skins getting into the soil and spreading the disease.

ONTARIO'S PART IN FEDERAL AGRICULTURAL CO-OPERATION.

W. BERT ROADHOUSE, DEPUTY MINISTER OF AGRICULTURE FOR ONTARIO, TORONTO.

I am here not so much to make an address as to make your acquaintance. It is well, it seems to me, that those engaged in organized effort for the Department of Agriculture should meet together from time to time and discuss matters of mutual concern. Since, therefore, fate or fortune has decreed that I shall be

associated with you, and those who like you are engaged in the promotion of everything which makes for better conditions of rural life through organizations, it is my hope that I will have an opportunity of meeting you from time to time in order that I may get in touch, as I am indeed in sympathy.

My part in the programme of to-night, which as the Chairman has pointed out is largely taken up with Ontario affairs, is to outline briefly a new and important development in agricultural work which affects this Province. The co-operation of the Federal and Provincial authorities began this year, and it seems to me not inappropriate that a factor which promises so much should at this early date be the subject of consideration by an organization such as yours, which has always taken a position of leadership in agricultural thought and organization.

Now, when we come to consider any matters relating to the relations of the Federal and Provincial authorities, it is necessary to look to the British North America Act, which is the source of the authority of both the Federal and Provincial powers. We find that the subject of agriculture is dealt with in Section 95, which reads as follows:

> "In each Province the Legislature may make laws in relation to agriculture in the Province, and to immigration into the Province; and it is hereby declared that the Parliament of Canada may from time to time make laws in relation to agriculture in all or any of the Provinces, and to immigration into all or any of the Provinces; and any law of the Legislature of a Province, relative to agriculture or to immigration, shall have effect in and for the province, as long and as far only as it is not repugnant to any Act of the Parliament of Canada."

In other words, it simply means that both the Federal and the Provincial Government have jurisdiction in carrying on agricultural work, provided only that should any clash or friction occur, the Federal authorities shall be supreme.

Long before the British North America Act, however, agricultural organization was making itself felt in this Province. The first organization took place in Niagara in 1792. Government aid was granted in 1830. Development was gradual but continual, leadership being taken largely by the now historic Agriculture and Arts Association, until in 1888 agriculture was made the subject of a separate department of the Provincial Government. Before that date, however, an important start had been made by the founding in 1874 of the Ontario Agricultural College. The Department assumed largely the direction of this College, and from it were built up numerous branches dealing with different phases of agricultural work. Hence we have to-day the Agricultural Societies Branch, Institutes and Dairy Branch, Live Stock Branch, Fruit Branch, Veterinary College, and last, perhaps as important as any, the work of the District Representatives. Expenditure on all these subjects has gone steadily on until during the year just closed, our appropriations aggregate almost a million, representing some eight per cent. of the gross expenditures of the Province. Let us see just what this means. I hold in my hand a statement of the gross expenditures and agricultural expenditure of over twenty States of the Union. These range all the way from 1.7 per cent. to 10 per cent. for agricultural purposes. It is worthy of note, however, that there are only two States which show 10 per cent. and that the next highest is 7.5 per cent., and the great majority are very much lower. It is safe to say, therefore, that in proportion to population Ontario is spending more on agricultural work than any other Province or State on this continent. It may be that there is a connection, and an important connection, between this fact and the other proud fact that the yields per acre show Ontario to be the most fertile spot on this continent. Yields per acre not only thus vindicate the claims of the Province to

prominence in agriculture, but also reflect the progressive cultural methods of the farmers, which this organization has done so much to foster.

In the meantime, however, the Federal Department of Agriculture had been developing. It is now working through several branches including the Seed Branch, the Health of Animals, Transportation, Marketing—especially in reference to exports, Experimental Farms, etc. Thus with two Departments, Federal and Provincial, growing up, it was natural that there should be some overlapping and perhaps some duplicating. Such was the situation in 1912 when the new Government at Ottawa proceeded to look about to devise new lines of agricultural work. They were confronted by two alternatives: whether to broaden out and build up the Federal Department, or to give aid from the Treasury which could so well afford aid to the Province which had the organization, which could so well do the work. They very wisely decided to do both. They have extended and strengthened the work of their own Department, and they have at the same time adopted a plan of financially assisting the provinces in carrying on work through their local organizations. During the past year the grant was $500,000 divided among all the Provinces. Of this amount Ontario received $175,000. The details of the expenditure of this money are no doubt familiar to you and it is not my purpose therefore to more than refer to one or two.

First and foremost I might point out that provision was made for a new Field Husbandry Building at this institution, which is now being constructed, and which we trust when completed will not only be an acquisition to the College itself, but also greatly facilitate the work in which your organization is engaged. Broadly speaking, the money was divided into two parts, a portion going for equipment by means of new buildings, etc., for agricultural exhibitions, live stock associations, etc., the other being provision for the carrying on of all those branches of work which promise to most intimately touch and benefit the man on the farm.

But while we have thus been carrying out our part of the temporary policy, the Federal authority has been devising plans for a permanent scheme. Their first step was to select a man to make an investigation of existing conditions, and in that connection they were fortunate in securing the services of Mr. C. C. James, than whom none better qualified could have been secured anywhere in this broad Dominion. He has visited the various Provinces, consulted those in authority as to lines of expenditure, and has, I believe, submitted his views to the Federal Minister. The result it is expected will be embodied in legislation which has been foreshadowed, but which has not yet been introduced. We can only take what was contained in the Speech from the Throne at the opening of the Session, and I would ask your attention while I read the paragraph on this point.

"It is satisfactory to know that the proposal of my Government to co-operate with the Governments of the various Provinces in promoting the agricultural industry has met with hearty approval. The appropriations which were made last session in connection therewith have proved to be of marked benefit to the country. After a careful study of the whole question, my advisers are convinced that co-operation with the Provinces on well defined terms and conditions will achieve the best results along the lines of agricultural instruction. Any such policy to be effective must be continuous. Accordingly a bill will be introduced by which a substantial amount of money will be set apart from the Consolidated Revenue Fund for the purpose of assisting the Provinces for a term of years in this highly important national work."

In view of these statements it is not too much to look forward with hope and confidence to a permanent scheme for agricultural instruction, based on the broadest and sanest lines, by which the Government which has the money will assist the Governments which have the organization.

The question must then be asked and answered as to how this money should be spent. This is a question which should, and no doubt will, occupy the attention and thought of the best minds in agricultural matters in the Province. In the meantime it is only possible to mention certain broad, general principles which might well be kept in view.

In the humble country home in which I was born and brought up there hung a motto which read "Knowledge is Power." These words are as true to-day as ever. Here at this institution we have the accumulated knowledge of years on agricultural subjects. Knowledge gained through experiments in the field, experiments in the feeding barn, experiments and research in the laboratory. It is, however, a well known elementary principle of agricultural science that the measure of the fertility of the soil is not the measure of the plant food which it contains but the measure of the plant food which is available. Similarly, I say that the measure of the effectiveness of agricultural work is not the amount of knowledge which is accumulated and stored up at the Agricultural College or at the Department in Toronto, but rather the measure of the knowledge which is made available from one end of the Province to the other. Let me illustrate this point further by a simile which seems to fit the situation exactly. Yonder are the great Falls of Niagara. However, had it not been for the money and the skill of man they would have been noted for little save their majestic beauty. But the money and the skill of man has been directed towards the building of transmission lines, and these transmission lines carry the energy developed and light the lights and turn the wheels and add to the comfort and wealth of thousands of people hundreds of miles distant. Similarly, it is necessary in our agricultural work to keep in mind the necessity and importance of such transmission lines. The 5,000 experimenters who are represented in this Association, the 700 Farmers' Institutes and Women's Institutes, the 200 Clubs, the 350 Agricultural Societies, should all be transmission lines of agricultural knowledge. But above all, the most effective work being done in this way is through the thirty-one local offices of the Department of Agriculture which are now located in as many different Counties throughout this Province. We have done a great deal, therefore, already in the planning and arranging of these transmission lines for agricultural knowledge, but there is still a great deal more to be done. We need to disseminate knowledge on quality, and when we have achieved these two purposes, as we have already achieved them in many parts of this Province, we will have to go further and disseminate knowledge on the subject of marketing, which is each year becoming a more important subject in the success of agricultural work.

There is therefore room for a broad and systematic and successful plan, but I would ask you to remember this—I leave this thought with you—that all the co-operation of all the Governments will avail but little unless it arouses a corresponding spirit of co-operation, a corresponding enthusiasm, a corresponding vision of the possibilities to the individual to the Province and to the nation in the minds of those whom all Governments exist to serve, namely, the farmers of the country.

ONTARIO.

HON. W. H. HEARST, MINISTER OF LANDS, FORESTS, AND MINES, TORONTO.

It gives me a very great deal of pleasure indeed to have the privilege of addressing the members of the Experimental Union, composed as it is, of men who are interested in the great basic industry of our Province, that industry upon which the success and the prosperity of our Province so largely depends. I was thinking to-night how greatly matters have changed in connection with the agricultural industry in the last few years. It is not so long ago that it was not thought necessary to have any scientific knowledge or training in order to follow the pursuit of agriculture. Courses of instruction were provided for almost every other profession or calling in life, but it was thought nothing of that kind was necessary for the man or boy who followed the farm. Now, that is all changed, and I think I am safe in saying that there is no industry of any kind that requires so much technical knowledge as does that of agriculture, and no industry that yields as good returns as what agriculture does. So I am delighted to-night to see such a gathering of men who have the interests of that branch of industry at heart.

For many years past, with my somewhat busy life, I have been looking forward to the pleasure of paying a visit to your College. To-night, though, is the first time that I have had that opportunity. I hope to be able to see more of your institution than what I have yet been able to. I have often heard of the fame of the boys of the Agricultural College, and I have long desired to have a look into the faces of some of the students here.

To-night I want to enter into the spirit of this Province of Ontario with you. I want you to go with me, and think with me of the great position that you hold, of the splendid education that you are getting in that great industry of agriculture, and of the great influence that you may wield and I know will wield in farming, not only in its practical side, but also in its social and political life in the days that are to come.

I will in the first place, try to speak to you, passing over the subject as quickly as possible, with reference to the extent and diversified resources of the areas in the Province of Ontario. First, bear with me while I give you a few figures with reference to the extent of the Province. It is difficult for us always to understand its extent of territory, much less its extent of resources. Take the Province of Ontario as it existed prior to 1912, 260,882 square miles. You know that during last year there was, by the legislature of the Dominion Government, concurred in by the Province of Ontario, added to the Province of Ontario, the district we now call the District of Patricia, 157,400 square miles, making the present area of the Province of Ontario, 418,282 square miles. This makes the Province of Ontario the second largest province in the Dominion, the Province of Quebec, with the District of Ungava added, as it recently was to it, is 706,834 square miles.

I am not going to say to you very much about the newly added District of Patricia. We might spend an interesting night speaking of that great district. We do not know very much of it yet. We know, however, that from the geological formation of that country it has great mineral possibilities. We know that it has some timber wealth; we also know that it has some agricultural wealth. Mr. Tyrrell brought back to me splendid samples of potatoes from the district round Trout Lake, some 300 miles north of Port Arthur.

But the District of Patricia perhaps from an agricultural standpoint does not interest us so much just at the present. We have so many thousands of acres of agricultural land in the Province which is nearer at hand than the District of Patricia; and so, to-night you will please bear in mind, in the figures that I give you, I am taking the remainder of Ontario, and not taking into account the District of Patricia at all.

Now, take what we call New Ontario, outside of the Great Lakes, into consideration leaving them out of the calculation altogether, we have an area of 175,500 square miles, west of Port Arthur, we have 41,500 square miles, east of Port Arthur; and South of the height of land, 52,000, north of the height of land and east of Port Arthur we have 82,000 square miles.

I have divided this Northern Ontario into these three sections in order that we might get a better conception of the different localities in that north land. Sometimes people from our cities go up into what they call New Ontario. They take a Pullman at the Union Station in Toronto, travelling by Grand Trunk to North Bay, and from there they take the Government Railway to the town of Cochrane. Upon seeing a few yards of one side off the railway alone as they go up, they come back and tell the people of Ontario that they have visited Northern Ontario. They know all about its climate, agricultural possibilities, its minerals and its timber, forgetting the fact that they might have travelled a thousand miles on either side, in a land waiting for the advent of man and capital in order to develop its vast natural resources and bring them to the use that Providence intended they should.

Let us look for a moment to the whole of the Province of Ontario. We have, approximately, 140,000,000 of acres. In that to-day, we have only surveyed 46,000,000 acres; we have left unsurveyed some 94,000,000, and the Province has only parted with some 24,000,000 of acres, leaving to-day with the Crown, 116,000,000 of acres in our own Province of Ontario, and that is outside entirely of the District of Patricia.

What have you in the Province of Ontario to-day under cultivation? Only 13,000,000 of acres of tilled land, less than 10 per cent. of the area still in Crown. Having that in mind, then, what is the Province of Ontario doing as an agricultural country? Ask yourselves that question, and you will find that the field crops, according to the statistics furnished of the whole Dominion for the year 1911, amounted to $565,711,600, while the value of the field crops of the Province of that year amounted to $193,260,000; or, in other words, the field crops of the Province of Ontario was considerably more than one-third of the whole of the product of the Dominion. Let us think that over for a moment again. The field crops of the Province of Ontario are now over one-third of the product of the Dominion—larger by $13,000,000 than the product of Manitoba and Saskatchewan, the two largest provinces of the West, and you have only one-third, or possibly only one-quarter of the land now under cultivation that is capable of profitable cultivation. To my mind it simply means that the Province of Ontario will in the days that are to come, keep her banner position as an agricultural province in this fair Dominion of Canada. We think a great deal of the great wheat producing provinces of the West, and no one glories in their progress more than I. But I am no less a good Canadian, I am no less proud of the provinces of the West, because I love my own Province of Ontario more, and I am anxious to see her prosper and grow and keep her position in the future as she has in the past—the banner province of the whole Dominion.

Let us look for a moment at the agricultural possibilities of Northern Ontario. I am not going to speak to you at very great length to-night of the mineral and timber possibilities of that land, because we all recognize, that important as our minerals are, and important as our timber is, there is only one crop of them. The mine does not reproduce itself, and once you reap a timber crop, ages almost pass before another crop has become matured from the same ground. But the agricultural crop, year in and year out, goes to make for the betterment and the commerce of the country at large. And so it is the agricultural possibilities of that northern land that speak the strongest to me. Now, what have we there in the nature of agricultural land? We have the clay belt, said to contain some 20,000,000 of acres. But we have not alone the clay belt, although you hear most of that; in the Districts of Nipissing, Sudbury, Manitoulin, Algoma, Thunder Bay, Rainy River, and Kenora, there are millions of acres of just as good land. In Northern Ontario you have under cultivation perhaps an area twice or three times as large as you have now in the Province of Ontario. Take in the District of Rainy River, and I believe there is no more valuable, fertile land anywhere than there, you find some as fine tilled farms as you can find almost anywhere. I visited one of their agricultural fairs there this fall, and I saw roots, and grains, and vegetables of different kinds, that far surpassed anything I saw at Toronto in September last. That country has many advantages to the colonist. Last year the settlers in that country sold timber alone worth $260,000, showing one great advantage that he has in that country, and in every other section of Northern Ontario, that he does not possess in the great provinces of the West. I want to emphasize that it is in the section to the north in which we have the splendid agricultural lands. Take the District of Algoma and you will find some as well tilled farms there as you can find anywhere. You will find as good fruit, speaking particularly of the more hardy varieties, as you can find in the Province of Ontario. And you will also find as good dairying there as anywhere.

I might speak for considerable length on the possibilities of the different parts of the country, altogether apart from that which Mr. Englehart spoke to us so eloquently to-night. But one of the beauties of that great north land is the development of its resources and its possibilities. It is not confined alone to agriculture. Take its mineral resources, and they are great. What are we doing along that line? The mineral production of Ontario last year was $42,000,000, an increase since 1904 of nearly $30,000,000. The Cobalt to date has paid to the mine owners $65,000,000. It is something to boast about, that of all the silver that comes from the earth's crust, one ounce in every seven comes from the Cobalt camp, that the Province of Ontario is now the third country in the silver production of the world, being exceeded only by the United States and Mexico. It is also something to boast about, that the Sudbury District produces 70 per cent. of the nickel of the world.

Leaving out coal, of which the Province of Ontario has none excepting "white coal" of the hydro-electric type, Ontario's production of minerals is worth more than that of all her Sister Provinces combined. But not alone have we the silver of Cobalt, but we have gold of Porcupine. Porcupine is producing for the first time to any extent this year, and already $1,500,000 have been produced from that camp, producing in the last two months twice as much gold as ever was produced in the Province of Ontario in 24 months before. We have silver and gold mines stretching over an area from Quebec on the east to Manitoba on the west. How many of those will prove productive mines we cannot tell, but as the

Temiskaming and Northern Ontario Railway opened up the Cobalt, as the Cobalt Railway opened up the Copper Cliff, so I think other railways and roads will open up equally valuable gold and silver camps that are not yet known to the prospector in the Province of Ontario. We have great opportunities along that line to be unfolded in the days that are to come, but not alone have we the precious metals which are important in themselves, not alone have we the nickel that I have spoken about, but we have iron in very large quantities, and to my mind it is very much more important indeed to have a good supply of iron in a country than it is of any other metal. In iron we have large known deposits at the present time, and undoubtedly many more will be developed in the future.

But not alone have we the agricultural lands, and the mineral lands, but we have in that north land a splendid asset in the shape of timber. You recognize what an important thing it is from an industrial standpoint, to have a good supply of timber, as well as from a revenue producing standpoint. We have collected in revenue from the timber of the Province from Confederation down to 1910 over $44,000,000, or a yearly average of income from our timber alone of over $1,000,000. The forest production of the Dominion of Canada in the year 1910 were valued by the Conservation Commission at over $166,000,000, or practically $22.00 for every man, woman and child in the Dominion of Canada, showing the importance of the timber industry in the Dominion.

What have we in the nature of timber resources in the Province of Ontario? The figures that I give you are only approximate, but they are well within the mark. We estimate that we have of red and white pine on lands of the Crown over 13,500,000 feet, that is easily worth as it stands to-day, $10,00 a thousand, or $135,000,000. We have Pine on licensed lands at least 7,000,000 feet or more. worth to the province at least $1.50 a thousand, or round figures $10,500,00. We have at least a million cords of Spruce wood. That means a great thing for the Province of Ontario, and it means a great responsibility for the Department over which I have the honor to preside, that is the conservation of that timber so far as is possible for the future, and getting the best from it for the present.

Then the question comes of what is to be done with the timber that naturally will be cut away. This is one of the problems which we have to face and solve to the best of our ability. We are trying to induce the establishment in that north land of pulp and paper mills, as well as other industries, as an inducement for people to settle there. And so in that connection we have recently secured the establishment of a large pulp and paper plant at Abitibi. That, however, is only one of the industries that have been already established in Northern Ontario. At Sault Ste. Marie we have a large pulp and paper factory employing a large number of men. We have a large iron industry there employing a great number of men. Coming further eastward again at Espanola and Sturgeon Falls we have pulp and paper mills there. Getting into the Rainy River country we have the large paper mill which is just about completed—one of the very largest on the continent, again helping to buy up the settlers' pulp wood. All these are being established to use the raw materials of the North land and we believe they are only the forerunners of many more that will be established in that country.

Let me tell you of some of the industries that have already been established and that will suffice to show you what the others may do. Take the City of Sault Ste. Marie, where they have already a large steel plant, paper plant, and large works in connection with their railway and allied industries at that point. It means a splendid consuming market not only for the locality in which it is

situated, but for the whole Province of Ontario. There is scarcely a section in the Province of Ontario that has not felt the advantage that has been exercised by the establishment of these plants, at Sault Ste. Marie, Sudbury, and elsewhere in that north land. It is a matter of advantage to the Province of Ontario that we should work shoulder to shoulder for the development of that new country so far as we possibly can.

But so much for the development already accomplished. Let me say that while we have good agricultural land in New Ontario I do not pretend for a moment that it is all good agricultural land. Much of this land is good for forestry purposes, good for the growing of trees, and it is in connection with this that we are directing our energies for the future. In this connection I have recently added to my Department, Prof. Zavitz, a man who will advise me of the best means to take for the development of the great timber belt in that country. One of the great things we have to guard against is the destruction by forest fires. That will be within Mr. Zavitz's duties, to carry out a scheme for the destruction of the limbs and the debris as far as possible, so as to prevent danger from fire. The subject is a large one and is one that would take a night to go into any intelligent discussion on, and I can only glance at it for a moment. Suffice it to say that it is a subject that many discuss who have not given it practical consideration and study, and it is only when such due deliberation is given that one realizes the possibilities and the task that we have on our hands.

But another thing which is being done by the Province for the conservation of its timber, is the setting aside of large forest reserves, in which settlement is not permitted, so that there will be no danger of fire from that source. We appoint rangers and do all we can to prevent from depredation the trees that are growing there. These we hope to preserve for future generations. You must understand that a tree ripens just as any other thing does. You get ripe timber as you get ripe crops, and when once a tree comes to maturity then it starts to deteriorate, and unless that tree is cut when this stage is reached the Province loses to a certain extent, sometimes to the full value of that tree. The question of how to cut that timber so as to not destroy the balance of the trees that have not come to maturity, is a problem which will have to be solved in the near future. We have in our forest reserve the National Park at the present time, an area of over 20,000 square miles. We estimate that we have over nine and a half billion feet of pine, 15 million cords of pulpwood, and 2 million cords of spruce, on that land, so you see that we have a great asset for the future in connection with these reserves.

Not only have we the agricultural possibilities, the mineral and the timber, not only have we a certain amount of railway facilities, but Nature has immensely blessed that country with its rivers and streams, and it is said that from the Province of Quebec to the Nelson River we have some 100 rivers which are navigable to a greater or less extent. The Transcontinental Railway, itself, has to cross some 30 rivers emptying into James Bay that have a certain amount of navigability about them. So you will understand the advantage that is to the country, particularly as a means of floating timber to the market.

But there is another matter which is especially important in connection with that country, and that is the immense amount of water power that these rivers afford. One of the engineers of my Department claims that within 100 miles of the Transcontinental Railway they have at least 2,000,000 horse power. What then, does it mean for that great north land? It means, I believe, that in the days to come, not only will one have electricity to run the mills, as they have

to-day to run their concentrators, their pulp and paper mills, and to light their streets and their homes, but it means that the settler in that land will have cheap electricity and looking from the demonstration that we saw at the National Exhibition last autumn, it will not be very long before the farmer will have electricity to practically do everything that is needed around the farm. Now, let us just take a look for a moment at what that generally means to the whole Dominion of Canada. In years that have gone by, what have you heard? That there was a great barren stretch between Quebec on the east and Manitoba on the west. You will remember what was said in the early years of the construction of the Canadian Pacific Railway. That there was a large tract of land for hundreds of miles along the north shore of Lake Superior in which they gathered no local traffic. What will it mean in the future if I am right that we have all our material, in timber and mineral; that we have the agricultural land, that I have told you about, besides the unlimited power of which I have just spoken. Why, there is only one result—that this great land will be one of the most important manufacturing centres of the Dominion of Canada. It will be a home of industry, helping to make our fair Dominion of Canada, a greater influence still; yes, I believe in the years to come it will prove a dominating power in this great British Empire—an empire whose power is so great, whose path is duty.

THE CLIMATE: Sometimes you hear tales of the great frozen north. It perhaps will surprise you to learn that the weather we have had so far, this winter, has been as moderate as you have had in the city of Toronto. It perhaps will surprise some of you to learn that they can practically grow anything in that north country, except perhaps in the fruit line, that can be matured in any of the southern parts of the Province of Ontario. The climate of Cochrane is practically the same as Winnipeg. Cochrane lies south of Winnipeg, and much of what we call Northern Ontario lies south of the international boundary. Let us look for a moment at the productiveness of the soil there; that is beyond all question. Many of you, I have no doubt, have seen the demonstration car that has travelled through the Province of Ontario showing you the productions of the north land. It is a country of wonderful richness. Its soil has a peculiar character of its own, of great depth, and of great possibilities. You will find there, as good crops perhaps as you will anywhere, but I want to-night not to give you my word as to what is done there or on its possibilities, but I want to give you the words of one of the graduates of your own college, those of Mr. Galbraith, the District Representative of the Agricultural Department, and supervisor of the Experimental Farm at Monteith. He makes these statements regarding the soil of the Clay Belt, where clover "grows wild" and "timothy luxuriantly:"—

"The soil is a rich alluvial clay, that is capable of supporting a crop of clover even though every vestige of humus be burned off the clearing. The secret of its peculiar adaptation to the growth of legumes seems to lie in the fact that the soil throughout the entire belt is exceptionally free from acid. The settler is fairly safe in concluding that there is no 'sour' soil in Temiskaming, not because there is no acid formed, for the extensive decay of organic matter on the surface throughout the woods is bound to produce a great deal of humic acid, but the fact remains that the lime content is adequate in every instance to correct all acidity and thus render the soil a hotbed for the reproduction of the different forms of bacteria that are essential to plant growth. The large percentage of lime present also accounts for the friable nature of the clay, which does not bake to the extent characteristic of clay soils elsewhere."

That was one of the things which I marked particularly in my different visits to that country. In the clay soils further west in the Province of Ontario, and in the County of Bruce, when it baked it was practically as hard as a brick.

Mr. Galbraith points out that any land, on which clover grows as abundantly as it does on the soil of Temiskaming, is practically inexhaustible in its fertility, as the essential nitrates may be continually renewed by the seeding down of the land in clover, alfalfa, etc., at periods of three or four years.

Mr. Whitson, who through my Department had charge of the expenditure of the money appropriated last year for the development of Northern Ontario, sent me down at the time of the National Exhibition at Toronto, a sheaf of wheat, and it was as fine a sample of wheat as was exhibited at that exhibition.

One of the things that they have particularly gone into in that country is the production of grass and clover seed, and I want to give you the actual result from one farm in that country—that of Mr John McFarlane:—

Hay, at $12.00 per ton	$1,200 00
Timothy Seed	450 00
Red Clover Seed	202 00
Other Seed	90 00
Fall Wheat	252 00
Spring Wheat	343 00
Peas	218 00
Barley	210 00
Oats and Potatoes	462 00
Or a total production of	$3,427 00

That, of course, was the gross product of the farm, from which all his expense of production had been taken. The local market that they have is giving especially good market and export prices for many of the products, while the farmer of the west has to transport his wheat and his products for thousands of miles in order to obtain a market for it.

And now, perhaps, you will ask, how is it that we have not made greater progress in the north than we have up to the present time? Let me tell you that we have been doing very well in the recent days, so far as settlement is concerned. Five years ago there were not more than 5,000 people in Temiskaming. Now we have 70,000 to 80,000. A few years ago the only railway we had in that country was the Canadian Pacific Railway, running east and west, for that railroad was built simply for the purpose of forming a means of communication between the East and West, and it was built where construction was easiest and cheapest, without regard to the development of the country through which it passed. They followed what is practically the Height of Land between Lakes Huron and Superior and Hudson Bay, the most barren and God-forsaken country in that whole North land. But things are now changed; things have already changed. We have the Canadian Pacific Railway of which I have already told you, we have the National Transcontinental, for 761 miles through the Clay Belt, we have the Canadian Northern under construction, and which when completed will have over a thousand miles in Northern Ontario, we have the Temiskaming and Northern Ontario Railway, with 253 miles from North Bay to Cochrane; it means that in a few years we will have over three thousand miles of railway opening up that whole North country. It means that you will have it opened up by railway, and you will have it filling up with settlers. And I would ask you to bear with me just for a moment to understand what we are doing already with settlement in that country. This year, I would point out that in four agencies alone, the agents in

nine months sold over 212,000 acres of land. We have not opened up lands to any extent along the Transcontinental Railway, because that railway is not yet in operation. What will be the result when the Transcontinental, The Canadian Northern and the Algoma Central which is building a big stretch of railroad up there, are in operation—all vitally interested not only on account of traffic, but on account of their lands in settling up the country.

I believe that in the lower portions there are opportunities for some intensive farming, but if you want to get opportunities in a new land, then I say, before you leave your own banner province, go to the northern part of Ontario and see for yourselves the great heritage we have there.

These are some things that we have to think about and ponder over in connection with that whole question. I want to point out the great importance, and the great duty of you young men, with the advantages you possess to-day, living in such a country as we have at the present time. You young men with your learning and with your knowledge have the advantage of spreading not only the gospel of better agriculture, but you have the advantage of being able to lift to a higher plane the social and political life of the people amongst whom you are to work. Our immigration is increasing every year, and it is well that it is so. But these people need to be taken care of and trained. It is your duty to preach the gospel of Canadianism and of British institutions and high ideals, so that your influence will lift up the great army of people who come to our shores.

THE O.A.C. REVIEW AS A FARM JOURNAL.

J. H. Winslow, Chelsea Green.

The *O.A.C. Review* is the official organ of the Experimental Union. It is divided into two large departments, the College Department, and our Agricultural Department, which consists of 30 to 40 pages each month. There is plenty of valuable information about the College here which is not as available to the farmers as it might be. Anything that is new in agricultural science is published in *The Review,* and we, from time to time publish articles by leading students of the various phases of agriculture. That is one of the means we take of helping the farmers of Ontario. We will publish correspondence from any farmer in Ontario on any subject which he may want to discuss, for instance, the work of the Government, rural mail delivery, parcel post, or anything of that kind. Many articles on economic questions are printed in our journal, and the other articles in our paper are all by practical men in agriculture. Every article should be of great interest to the farmers in Ontario.

We have a query department in *The Review.* We are right at the source of information here, and we should be able to get information more readily than any other paper. If you would like an answer right away, if you will send a stamped envelope we will mail you an answer at once, and put it in the next issue along with all other answers as well.

I want to tell you something about the work of editing a newspaper. *The Review* last year cost about $5,000 for 10 issues. If we bunch all our subscriptions it would not pay for two of them. Of course, the advertising pays for the difference. But the more subscribers we get the more we will be able to get for our advertising, and therefore, we will be able to give our subscribers more for their money.

Therefore, gentlemen, I would like you to, if you feel that way, to contribute the 50 cents. The regular price is $1.00 a year, but we are making a special rate of 50 cents to members of the Union and ex-students.

Hon. Nelson Monteith: As the time apparently is somewhat appropriate, I think possibly we might express our views regarding the *O.A.C. Review*. Having been a subscriber since the very first issue, I have taken a deep interest in its welfare from that time to the present. It does seem to me as years go on, possibly because I am one of the back numbers, that it is not just in as sympathetic touch with the ex-student body as it might be. I know the present student body is large in itself, compared with what it was in the past, and naturally the staff at the present time look upon the present student body as all in all. We who have passed out do not feel that way. We feel that we are part of the bunch yet. I do not know, but possibly the fault is much on the part of the ex-students. They should from time to time send in in the way of correspondence anything that would be of interest to the other students of their time. I think possibly we are the ones at fault more than the staff. Naturally, the getting out of a journal such as the *O.A.C. Review* as it is at the present time, requires a great deal of their time, and I think it devolves upon us as ex-students possibly to send in articles from time to time that may be of interest to those of our time. I just throw these out as suggestions that *The Review* might be made more interesting to those of us who are of the earlier years of the College. I hope the seed may fall on good ground and bear good fruit, and that it may have the effect of bringing the ex-students in closer touch with the journal.

FORTY-FOURTH ANNUAL REPORT

OF THE

Fruit Growers' Association

OF

Ontario

1912

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO.)

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO

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1913

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TORONTO

To His Honour SIR JOHN MORISON GIBSON, Knight Commander of the Most Distinguished Order of St. Michael and St. George, a Colonel in the Militia of Canada, etc., etc., etc.,

Lieutenant-Governor of the Province of Ontario.

MAY IT PLEASE YOUR HONOUR:

I have the honour to present the Forty-fourth Annual Report of the Fruit Growers' Association of Ontario.

Respectfully submitted,

JAMES S. DUFF,
Minister of Agriculture.

DEPARTMENT OF AGRICULTURE,
TORONTO, 1913.

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Fruit Growers' Association of Ontario.

OFFICERS FOR 1913:

President.....W. H. Dempsey, Trenton.
Vice-President.....Robt. Thompson, **St. Catharines.**
Secretary-Treasurer.....P. W. Hodgetts, Parliament Buildings, Toronto.

Directors:

Div. 1. R. B. Whyte, Ottawa.
2. C. W. Beaven, Prescott.
3. W. H. Dempsey, Trenton.
4. Wm. Stainton, Oshawa.
5. W. J. Bragg, Bowmanville.
6. H. G. Foster, Burlington.
7. J. W. Smith, Winona.
Div. 8. R. Thompson, St. Catharines.
9. Jos. Gilbertson, Simcoe.
10. D. Johnson, Forest.
11. R. R. Sloan, Porter's Hill.
12. F. M. Lewis, Burford.
13. W. J. Saunders, East Linton.

Ontario Agricultural College: Prof. J. W. Crow.
Auditor: D. F. Cashman, Parliament Buldings, Toronto.

Representatives to Fair Boards and Conventions.

Canadian National: Robt. Thompson, St. Catharines.
London: D. Johnson, Forest; C. W. Gurney, Paris.
Ottawa: R. B. Whyte, Ottawa; Harold Jones, Maitland.
Ontario Horticultural Exhibition: Robt. Thompson, St. Catharines; Elmer Lick, Oshawa; H. G. Foster, Burlington; P. W. Hodgetts, Toronto.

Committees:

Transportation: A. Onslow, Niagara; Geo. French, Sarnia; Elmer Lick, Oshawa; W. J. Bragg, Bowmanville.

Co-operation: Jos. Gilbertson, Simcoe; R. S. Duncan, Port Hope; Lorne Carey, Hamilton; W. J. Saunders, East Linton.

New Fruits: W. T. Macoun, Ottawa; Prof. J. W. Crow, Guelpn; F. S. Reeves, Vineland Station.

Historical: A. McNeill, Ottawa; W. T. Macoun, Ottawa.

FINANCIAL STATEMENT, 1912.

Receipts.		Expenditures.	
Balance on hand Dec. 31, 1911	$1,945 13	Annual Meeting	$338 50
Members' fees	469 99	Committees	298 75
Show:		Periodicals	591 60
Entry fees	180 05	Printing	20 75
Fruit sold	1,166 95	Postage	100 00
Grant	1,700 00	Show	1,520 92
Interest	71 08	Grants	300 00
		Miscellaneous	688 25
		Balance on hand	1,674 43
	$5,533 20		$5,533 20

(Signed) D. Johnson,
President.
P. W. Hodgetts,
Treasurer.

Audited this 13th day of January, 1913.

(Signed) D. F. Cashman,
Auditor.

Fruit Growers' Association of Ontario

ANNUAL MEETING.

The fifty-third annual meeting of the Fruit Growers' Association of Ontario was held in Toronto on November 13th, 14th, and 15th, 1912.

At ten o'clock a.m. on Wednesday, November 13th, 1912, PRESIDENT D. JOHNSON, of Forest, called the meeting to order and said:

PRESIDENT'S ADDRESS.

D. JOHNSON, FOREST.

We have again gathered at our annual meeting to discuss matters of interest to us all. The season, that is now fast drawing to a close, has had its advantages and disadvantages. The extremely cold winter through which we passed has affected some of us seriously, but generally speaking, the season has been quite above early expectations. The great awakening that has taken place during the last few years in the scientific care of orchards, has born fruit in many districts that formerly produced little or no fruit. The campaign of education to the producer has shown its value, and many orchards which were formally an eye sore and a disgrace to the farm on which they stood are now its pride and delight. Not only are farmers showing greater interest in their orchards now planted, but they are planting out apple, peach, pear, and plum trees as never before. So great is the interest of all classes in fruit growing and so rapidly is the area of orchards increasing, that it is very important that it should be guided along the best and most substantial lines.

We must produce such fruit as the demands call for, and our plantings should be such as would reap the reward of the future. In the apple season that is now on, we find that for certain varieties of apples there appears to be an unlimited demand. Such varieties as the Spys, Snows, McIntosh Red and King are in great demand at prices ranging from $3.50 to $4.00 per barrel at shipping point; while the Ben Davis, Baldwins and Greenings are almost a drug on the market, and moving slowly at $2.25 per barrel.

The great markets of the West and North are prepared to pay a proper price for what they want and we, as producers, should plant according to their demand. So enormous has been the planting of orchards this last few years that we are forced to face the question of over-production. That question has been the nightmare of the fruit grower as long as I can remember, and it looks to me that perhaps at some distant time over-production may come upon us, but, I believe, and firmly believe, that there is no danger of over-production as long as we produce that which the public demands, and drop the idea of trying to force the public to adopt the varieties and grades that we would like them to adopt.

I have noticed this season, with some alarm, that the Ontario apples are being driven out of the West to a very great extent by the competition of Western growers

and shippers. Our salesman has informed me that the Provinces of Alberta and Saskatchewan are using largely Western apples, and that, in spite of the most earnest efforts of Ontario salesmen the preference is given to Western apples on account of their superior pack. They will all admit that in flavor our apples far surpass them, but owing to the uncertainty of the Ontario pack, they are obliged to purchase in other places to protect themselves.

Thus, it is beyond doubt, a fact that we must produce a high quality of apples and a high grade of pack.

Western Ontario has this season a fair crop of apples, much larger than they have had for some years, and, I regret to say, that I believe fully 25 per cent., perhaps more, of the fruit has gone to waste. Some has been taken to the canning factories, some to the evaporators, but a large percentage has gone utterly to waste, and that which was bought by the buyers was bought at a price so discouraging to the grower that they have little or no heart to care for their orchards in the future.

It is a distressing fact that such conditions exist, and there is no reason why they should. The farmers themselves are largely to blame for any loss that they have had in that way, for by co-operating together they could have saved their fruit and made themselves good returns. The Department of Agriculture has worked hard to spread information regarding Co-operative Associations in many places, and in many places Associations have been organized and in almost every case they have met with success.

In my own County of Lambton some 40,000 barrels of apples have been handled in this way at prices ranging from $2.50 to $3.00 f.o.b., shipping point. While the apple crop has been large, yet, I am sure the entire crop could have been handled at good prices, but only through organization.

The peach crop of Ontario has been much larger than was at first expected. The cold winter had seriously hurt the buds in many places, but the crop was large and in some cases the fruit was allowed to go to waste. This again was not the fault of the market, but the lack of help and largely the lack of baskets, which shows the necessity of looking ahead and preparing for both labor and supplies.

It appears to me that an educational campaign of how to market fruit is now the crying need of the day. No matter how well we grow fruit, if we can't sell it there is no encouragement to produce.

We fruit growers are pleased indeed that the Dominion Government has made some advancements along lines suggested from this Association. Qualified fruit inspectors have been increased which has resulted in the better packing of fruit. A year ago we asked for inspection at point of shipment. To some extent we have been granted this, but in my opinion, it should be much more thorough than it now is. Inspectors should be not only inspectors, but instructors as well. If they find it necessary to mark down a package they should be able to explain the reason why.

The past season has been one of marked activity of the Transportation Committee; often at great inconvenience to themselves they have met and planned how to promote the better transportation of fruit.

Mr. G. E. McIntosh has been appointed to take up this work under their direction, and has entered into a very careful study of the questions. It appears to some of us that the carrying companies are anxious to get all the business they can from us, and give us no more accommodation than they can. Mr. McIntosh has

been quietly gathering facts, which we are sure will bring results. We are fortunate in having a Railroad Board to which we can appeal, and, if denied our rights, can lay our requests before them. Mr. McIntosh will make a report before you, so that it will be unnecessary for me to go into the details.

Referring again to the fruit inspectors, I would suggest that they also be made cargo inspectors. We fruit shippers feel that, after we have guarded our trees from planting to maturity, and the fruit from blossoming to the barrel that we should not be the only ones watched in the marketing of it. If we deliver the fruit, especially the tender fruit, into the hands of the transportation company, we feel that it is only right that the fruit inspectors, in the discharge of their duties in connection with the packing, should see that the transportation company handle our fruit in a manner to assure us the best delivery of it.

There is little encouragement in the shipping of tender fruit if it is going to be knocked about, destroyed, and rendered largely unsaleable in transit. Nor, do we feel easy about our shipments to Europe. We are told that everything that can be done is being done to market our fruit in good condition in those markets. Yet, the returns show so much depreciation on arrival that we well may ask the reason why.

We can ship apples to Calgary and far western points and, while our cars often do not travel faster than five miles an hour, yet, we seldom have trouble in landing them there in good condition.

Our transportation manager is trying to solve those problems, and we have every reason to believe will do so soon. During the past winter the Dominion Fruit Conference was held at Ottawa, where many questions of interest to the fruit growing industry were discussed. A number of resolutions were thrashed out and agreed to by the representatives of the various provinces, most of which, I regret to say, are apparently still on file. Whether they will be put in force yet remains to be seen. I can scarcely believe that any Government will be so blind to their duty as to fail to carry out the demands of the people, especially when those requests are presented by men in the foremost ranks of Canadian fruit growers and shippers, who have spent their life in working out the many problems of the industry, and who have nothing but the welfare of the fruit growing industry at heart.

Mr. Wm. Armstrong (Queenston): With reference to your point in regard to the transportation and handling of tender fruits, we as peach growers never suffered as much as we have done this year. It is simply ridiculous, and out of the question, for the growers to put up with it. Right here at Toronto is the greatest grievance of all, and why the citizens of Toronto have not concurred in our oft repeated enquiries with regard to a different market than the Scott Street market I am at a loss to understand. Certainly the time has arrived for something to be done. The fruit is thrown around and packed up ten or twelve tiers high The baskets with what we may call patent covers ought to be piled with a certain amount of discretion. When it comes to the patent cover it is really a shame to see how they are treated on arrival at the Yonge Street wharf. They are thrown down, and I am told, piled as high as eleven tiers. They have no room and no facilities. Sometimes there are not sufficient trucks to handle the business in the Niagara district. There were one or two occasions when the wharf at Niagara was covered completely and the boat left them there. They hadn't room for them even on the boat. That occurred once, if not more than once. Mr. Onslow could

speak more definitely as to Niagara, but I speak more particularly as to Queenston. The boat certainly did its best to give us accommodation, in fact it was the best accommodation we ever had, and yet they were not able to handle the business.

MR. W. H. BUNTING (St. Catharines): In the course of your address you have raised some very important points in connection with the fruit growing industry in this Province. I do not think we can take up these points intelligently, and deal with them as their importance deserves, in the limited time at our disposal, and I would suggest that a Committee be appointed to take up the matters that are of outstanding importance, to bring in a report during the progress of the Convention. If my suggestion meets with the approval of the meeting I would name Mr. W. F. W. Fisher, Mr. Kimmons, Mr. McIntosh, and Mr. Onslow as a committee to bring in a report on the President's address.

MR. L. A. HAMILTON seconded the resolution, which, after discussion, was adopted.

THE PRESIDENT: This is a very serious problem we are up against at the present time. Most of us who are present understand the production of fruit fairly well, but we find we have difficulties in marketing it, and one of the great problems in marketing is the transportation question, which Mr. McIntosh is making a special study of. There is very little encouragement in producing tender fruit if it is going to be knocked around the stations like old boots. We are sick and tired of the method of transportation, both of the railway companies and the express companies, and something must be done, and I am glad to hear the opinions that have been expressed.

MR. WHITE (Ottawa): I do not know whether it is known to the Committee, but it is a rare thing for a small shipment of peaches to arrive without some of it being stolen. In one case I had ten per cent. of a shipment stolen by the expressmen. That is a very serious matter, and it interferes very much with what would be a profitable business to the fruit grower. I mean the shipment of small lots to families. As it is, people are afraid they will never get them. In this case there were ten baskets of peaches sent to me by my brother. Two baskets were opened and over half of them stolen. I think if the Committee could bring pressure on the express companies they could stop it. It is a rare thing for any other kind of goods to arrive with a case broken open and part of them taken, but it is a regular thing with peaches.

THE PRESIDENT: They give you nothing but impudence. I think the Association is alive to the necessity of some action of that kind. We pack our fruit carefully and deliver it to the express companies as carefully as possible, but if they only take out one or two peaches it upsets the whole package. They are delivered probably in bad shape, and then they blame us for it, and we get into trouble. We are losing thousands and thousands of dollars every year. We do not mind paying for a thing if we get proper service.

MR. WHITE: If we had a wooden cover well fastened down there wouldn't be so much of it.

MR. BUNTING: While that point is up, we have Mr. Kimmins with us, Mr. Smith's confidential man, and probably no man ships more peaches on order than Mr. Kimmins. I would like him to state what his experience has been during the last year or two with reference to the point Mr. White has raised. My own experience has been that there has been a great improvement in the shipping of private orders to my customers, and out of several hundred orders this year I had

very few opened, probably not over a dozen, but I have had it where perhaps twenty-five per cent. of the shipments would be tampered with. I think in one of the express companies, with their new president, Mr. Pullen, we will get more satisfaction than we have had before in many respects.

Mr. A. L. Kimmins: I think possibly our customers have suffered to some extent in the way that Mr. White and Mr. Bunting have referred to, particularly when it comes to small customers in out of the way places. A great deal of our trade of course lies with the larger dealers in the larger towns, and usually it is coming in such volume that we do not hear anything about it. However, I must say the point that Mr. White refers to about the flimsy cover that we use over the peaches, and the flimsy manner in which they are attached to the basket, is in a large way responsible for the trouble. I think it is about time that somebody invented a basket that would answer our purposes, which would not run us into too great an expense. There have been complaints every year come in, which we have forwarded to the superintendent of the company, and I think they are just as anxious to put a stop to the pilfering as the fruit shippers, but it is a difficult matter for them to get at the party who takes the fruit. With a view of reaching the proper party we have advised all our customers to refuse to pay the shipment charges except by actual weight. As most of you know the express charges are assessed on the estimated weight, and if the baskets are full, as they should be, when they start out, there is very little difference in the estimated weight and the actual weight, but in case of pilfering there is always a difference, and if the customer rejects the shipment and agrees to pay on the actual weight it necessitates an enquiry into who handled the shipment, and they find out through whose hands the shipment passed. If the men get to know that the shipments which pass through their hands are liable to be traced back to them they are not so liable to help themselves to the fruit. I do not think it is so much the messengers as it is the fruit being allowed to stand around in the stations and transfer points where it is not properly protected and guarded. This is a matter which might well be taken up by the Association and dealt with for it is a source of constant trouble and irritation.

The President: Apparently the managers of the express companies are anxious to place our fruit in as good condition as possible. We will grant that anyway, but their employees are not quite so anxious, and the result is we are suffering very seriously. Now, when we are packing peaches and plums we are responsible for the actions of our employees. If we do not pack our apples right our apples are turned down and we are liable to all kinds of trouble, and probably we are prosecuted in the courts. The transportation companies are responsible for the same thing if they do not look after their employees.

The President: This question of transportation will come up later and I hope you will enter into a very free discussion of it.

The Chairman: In the absence of Mr. Kimmins, who is chairman of the Special Committee, I will ask Mr. W. F. W. Fisher to make the report.

REPORT OF SPECIAL COMMITTEE.

We always find and expect to find any report made by our President brief but comprehensive. We find that he has dealt with a good many points on which this Committee felt it necessary to make recommendations. The Committee appointed to report on the President's address beg to offer the following suggestions:

1. In connection with that paragraph relating to the apparent loss of the western market to the Ontario fruit grower, we feel that there is still a very keen demand for Ontario fruit of all kinds, more particularly apples, as is shown by the enormous quantities shipped there this year, but a certain amount of trade has been lost owing to the western preference for box apples.

2. Your committee recommend that some steps should be taken to encourage the packing of apples in boxes to secure this trade. We suggest the establishment of packing schools during the winter months in connection with the Fruit Institutes. Some incentive to attend these, by the offering of prizes by this Association or by the Department of Agriculture is worthy of consideration.

We feel that this trade is too valuable to be lost for the want of adaptability on the part of our packers, to give the western people just what they want.

We would also suggest that if the Ontario Government place a special commissioner in the West during the ensuing season, that he be instructed and authorized to prosecute a rigorous educational campaign in favour of Ontario fruit, by judicious advertising and interviewing over the entire Provinces. In this way a demand for our fruits could be created in this vast market.

We cannot urge too strongly the absolute necessity of all apple packers raising the grade *above* the standard set by the Fruit Marks Act. It is a well known fact that sales have been lost owing to inferior packing in the past.

3. We think the remarks from the Chair about an educational campaign in connection with the distribution of fruit and other matters connected with that phase of the industry call for special attention at the hands of the Provincial Government.

Unfortunately those most heavily interested are extremely busy men and as any benefits accruing to an investigation of this kind are spread over the whole Province, we would recommend that a strong deputation from this Association wait upon the Ontario Government and request that a (Royal) Commission be appointed to thoroughly investigate all conditions relating to the fruit industry, including the production, distribution, transportation and consumption.

We feel that only in this way can the grievances of the fruit men be properly aired and remedies applied.

4. We would also recommend that further steps be taken to lay before the Dominion Minister of Agriculture the necessity of increasing the staff of fruit inspectors and that they be authorized to give a shipper a certificate for all shipments inspected at point of shipment.

We would also suggest that the sphere of these inspectors be enlarged so that they could prosecute under the Public Health Act, where shipments of fruit are offered that are unfit for consumption by reason of being over or under ripe.

We also feel that the scope of the Act might be enlarged to permit these inspectors to prosecute employees of transportation companies who carelessly injure shipments of fruit in transit. It is a well known fact that packages containing fruit, especially the more tender kinds, are subject to very rough usage which is just as injurious to the quality of the fruit as bad packing.

THE CHAIRMAN: Some of these suggestions are big enough to occupy a session in discussion. I am not sure whether you are prepared to pass them off-hand or whether you wish to discuss them at this time, or whether you will have them laid over for future consideration. It is your privilege to deal with this report as you see fit.

The report was adopted.

OUR MOST TROUBLESOME ORCHARD INSECTS AND DISEASES.

L. Caesar, Provincial Entomologist, Guelph.

It was my intention, when I undertook to give this address, to illustrate the most important points about each insect or disease by means of lantern slides, because I thought that in this way the subject would be much more interesting and instructive and the main things of value more easily remembered. However, since it has been decided not to hold any evening meetings I shall have to do the best I can to make my meaning clear by means of charts.

Fig. 1.—Orchard defoliated by Fall Canker-worms.
(Photo taken about June 12th, 1912.)

The Chief Insects of the Orchard.

Our chief orchard insects in the order I intend to discuss them, but not the order of relative importance are: Oyster Shell Scale, San José Scale, Blister Mite, Aphis, Bud Moth, Codling Moth and Plum Curculio. From time to time other insects in limited areas will do more damage for a season or two than any of these mentioned above; for instance, Tent Caterpillars did great havoc to unsprayed orchards this year in Eastern Ontario, and Canker Worms in the neighborhood of Dundas and Stoney Creek, destroyed almost every leaf in June in some neglected orchards. But such outbreaks as these soon pass away and can usually be easily controlled by careful spraying.

Oyster Shell Scale: The figure shows clearly the shape of this scale. In color it closely resembles the bark. The winter is passed in the egg stage beneath the scale there being an average of about 40 eggs under each scale. About June 1st when the blossoms are falling the young scales hatch out into tiny cream colored lice that run around a day or two then settle down and cover themselves with a scale. The females remain here the rest of their lives and lay their eggs under the scale in September. There is only one brood so that one scale on an

average cannot produce more than 40 offspring. Hence, the increase is not very rapid and though some orchards are being severely injured to-day such orchards once freed of this scale cannot become badly infested again for years.

Means of Control: The simplest method is to scrape the rough bark off the trees, prune them well and spray very thoroughly with lime-sulphur, specific gravity reading 1.030 which is equivalent to commercial diluted 1 gal. to 10, *i.e.* 9 gals. of water added to 1 gal. of lime-sulphur. If weaker lime-sulphur (1.008 sp. gr.) is used instead of Bordeaux just after the blossoms fall it will help to destroy the young lice. Usually it requires about two seasons to free an orchard of this pest. The scales though dead will often remain on the trees about two years before falling off and in that way sometimes make the owner think his spraying was ineffectual.

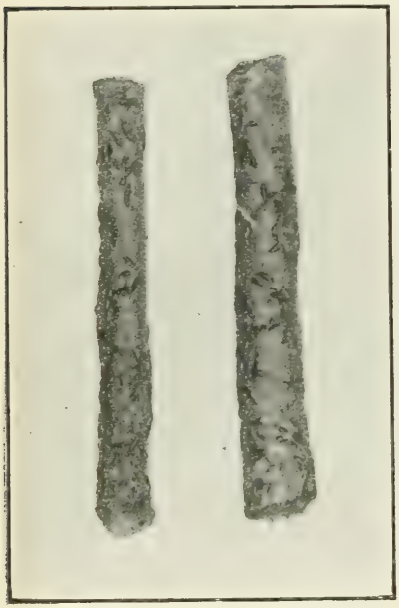

Fig. 2.—Oyster Shell Scale.

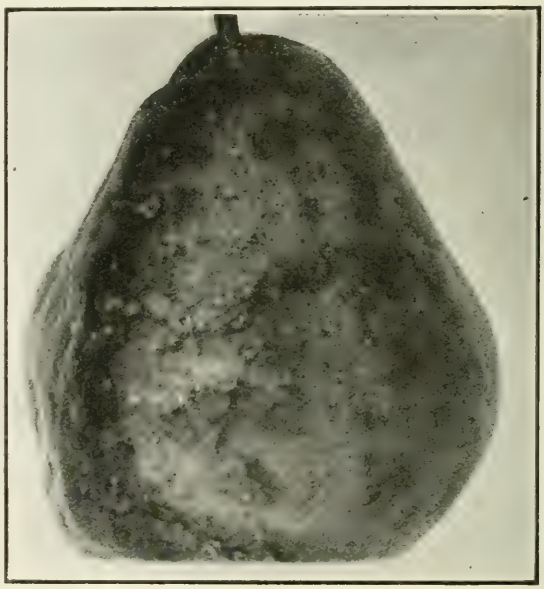

Fig. 3.—San José Scale on pear.

San José Scale: Wherever it occurs this is by far the most destructive insect pest that we have. It is spreading every year and already a large portion of the South-western part of the Province is infested. This scale attacks all kinds of fruit trees except sour cherry. It also is found on currants and rosebushes, and on mountain ash, hawthorn and other trees of the Rosaceae family. Once it gets into an orchard it will, sooner or later, unless kept under control by spraying, kill every tree though sometimes it will take many years to do so. Trunk, branches, leaves and fruit are all attacked. On the fruit red discolored areas usually are seen around the scale, caused apparently by some poison that is secreted by the insect. The scale as seen in the figure is very small, not larger in diameter than the head of a pin, almost flat, circular and of a grayish brown appearance, the centre being lighter. The winter stage is black with a distinct nipple in the centre and a little ring or groove around it and is much smaller than the adult scale. Its powers of reproduction are enormous. Each female scale gives birth to about 400 living offspring (no eggs are laid) and as there are

about three generations in a season in Ontario several million scales can be produced from one female before the end of the year. Breeding continues into October.

Means of Control: Careful pruning is always very important but especially so in the case of large trees. These will often have to be headed back to make the spraying easier. The pruning is chiefly to open up the trees so that the spray can be thoroughly applied. Rough bark must also be removed so that this may not protect any insects from the spray. The trees should then be sprayed with lime-sulphur of about 1.032 sp. gr. or stronger, that is commercial diluted about 1 gal. to 9. If any tree is badly infested, it should receive two applications, either one in the fall after the leaves are all or nearly all off and the other in spring before or as the buds are bursting, or both may be given in the spring, the one any time in March or April and the other shortly before the buds burst. To get good results every twig and part of the tree must be thoroughly covered from both sides; because, as we have said, from a single scale more than a million offspring may come in a season.

Fig. 4.—Blister Mite on leaf of apple and pear.

Blister Mite: Blister Mites are very tiny wormlike creatures not more than one-hundredth of an inch long, in fact so small that a single one is almost invisible to the naked eye. These mites attack the leaves of apple and pears and cause small blisters or swellings where they feed and lay eggs. The blisters are on the underside of the leaves and are at first whitish, later they turn reddish brown on the apple and almost black on the pear. Trees badly infested often lose many of their leaves, especially in dry seasons, when they can least afford the loss. I have seen leaves dropping from this cause as early as July. Even apart from the dropping of leaves the tree is weakened greatly because the part of the leaf where the blister is cannot perform its function of manufacturing food.

Fig. 5.—Cluster of small, woody, deformed Apples, caused by the feeding of aphids in the twigs and fruit.

Fig. 6.—All the buds except th ose on the extreme left in right stage to **destroy aphids by an early contact spray.**

Fig. 7.

Fig. 8.

(Most food of plants is manufactured in the leaves). Blister Mite is now found in almost every county. It is, like San José Scale, and Oyster-shell Scale distributed originally on nursery stock and then locally by birds or flying insects. (The mites are wingless). There are several broods in a season and the increase is rapid.

MEANS OF CONTROL: This pest is very easily controlled by a single very thorough spraying of the branches and twigs with lime-sulphur in the spring before or as the buds are bursting. It passes the winter under the bud scales and therefore every bud should be thoroughly covered. The strength mentioned for Oyster Shell Scale is plenty strong enough for this purpose. Thorough work will almost free an orchard in one season.

It will be noted that the spraying with strong lime-sulphur for San José Scale will kill also the Oyster Shell Scale and Blister Mite, three birds with one stone.

APHIDS: Aphids are among the most prolific of insects and because of this fact are capable of doing great damage. Fortunately, if we have a fairly dry and warm May and June the enemies of the aphids will usually hold them under such good control that we need not spray for them. If, however, the weather is wet or cold the aphids increase but their foes do not and consequently much damage may be done.

Fig. 9.—Bud Moth and larva.

Our most common aphids are: first the Green Aphis of the apple, of which there are two species, one remaining all season in the tree and the other (the most common one here) migrating from it in July to grass and other closely allied plants; second, the Rosy Apple Aphis, so called from a rosy tint showing through its powdery covering. This aphis also migrates to other plants in July. This was the most destructive apple aphis in Niagara district this year; third, the Black Aphis of the cherry which usually disappears almost entirely about July, but whether it migrates or is merely destroyed by foes like Ladybird beetles and their larvæ is not certain.

Aphids usually feed on the underside of the leaves, and cause these to curl and later turn yellow, and after a time drop off. If there are apples on the branch they are feeding on they cause these to become deformed, stunted and woody in tissue and to hang in clusters. Young trees are often badly weakened and dwarfed by their attack.

MEANS OF CONTROL: Many seasons, as mentioned, the natural enemies of the aphids control them sufficiently, but wherever an orchardist does not like to trust the work to these, there is no better known method than to add Black Leaf 40 to lime-sulphur and spray the trees a day or two before the buds burst. At this time the aphid eggs have all hatched, but there is no place where the young can hide from the spray. We got excellent results from this at the College this year. Instead of this combination, kerosene emulsion or whale oil soap may be used at this date, but the kerosene if made with soap, cannot be combined with lime-sulphur. (Lime-sulphur alone is not a remedy for aphids). After the leaves are opened kerosene emulsion or whale oil soap may be used.

Fig. 10.—Blossoms fallen, calyces open; right stage to spray for coddling moth.

Fig. 11.—Calyces nearly closed; almost too late to spray for codling moth.

Fig. 12.—Calyces closed; too late to spray for codling moth.

but we must not forget that the spray will not kill unless it covers the insects and the more forcibly it is applied the better. An excellent mixture is Black Leaf 40, to every 40 gallon barrel of which about 3 lbs. of common soap or whale oil soap has been added, the soap being first dissolved in boiling water. This is better than Black Leaf 40 alone. Once the leaves are badly curled it is too late to spray with any hope of success. One should remember that most aphids on fruit trees will disappear of their own accord early in July. It will pay well to spray currant bushes with one of these mixtures just before the buds burst.

Bud Moth: This is the little reddish brown caterpillar with a black head that is often found attacking the buds in spring as they are opening, and later feeding upon the leaves, it is almost always concealed in a little nest made from the curled edge of the leaf itself or of partly opened leaves fastened together. The most damage it does is by destroying the ovary or fruit forming part of the buds. Occasionally serious loss is caused. There is only one brood in a season. The winter is passed as a partly grown larva in little dark cases on the branches and twigs.

Means of Control: Thorough spraying with about 3 lbs. of arsenate of lead to 40 gallons of diluted lime-sulphur or Bordeaux mixture just before the apple blossoms burst will gradually bring this insect under control. Some claim that adding poison to the spring applications and applying it just as the buds are bursting helps greatly.

Codling Moth: The life history and habits of this our most common and destructive apple insect have been so fully described in bulletin 187 that I shall pass on at once to control measures.

Means of Control: A single thorough spraying with 3 lbs. of arsenate of lead added to commercial lime-sulphur diluted 1 gal. to 40 (specific gravity 1.008) will, if properly done, satisfactorily control this insect. The spraying must take place immediately after nearly all the bloom has fallen and must be all finished before the calyces have closed. A 10 foot bamboo pole with an aluminum rod inside and a large angle disc nozzle or two on the end is very satisfactory. The nozzles should be held close to the blossoms and directed straight into the open calyx. Every calyx should be thoroughly wet. If there have been many blossoms on the tree this cannot be done without drenching it. If the trees are high, build a tower on the spray wagon to get at the calyces better.

In districts like Niagara where the second brood is usually very destructive a second application about three weeks later will help. Arsenate of lead alone (2 or 3 lbs. to 40 gals. of water) should be used, the lime-sulphur not being added unless specially required for Apple Scab on account of wet weather.

Thoroughness and doing the work at the right time are the secrets to successful control of Codling Moth. Many growers in every district are to-day showing that this pest can be mastered if we really try. Half-way measures are no good.

Plum Curculio: As shown in the figure this is a small beetle less than one-quarter of an inch long, blackish in color, rough-backed and having a long snout. The larva is whitish, usually curled, with a brown head and no legs, thus being easily distinguished from the Codling worm and most other fruit infesting larvae. Apples, plums, pears, peaches, and cherries are all attacked. The simplest indications of attack in the early part of the season is the crescent-shaped scar made by the female around where the egg is laid. If the eggs hatch out, the feeding of

the larvae inside usually causes the apples, pears, plums and peaches to drop while cherries hang on but soon rot. Frequently, even though the eggs fail to hatch or the larva dies soon after hatching, punctured apples and pears are badly deformed as a result of the part around the puncture being retarded in its growth compared with the remaining parts. Late in the season in August and September, apples, especially those of the rough or medium rough skinned varieties, are often badly

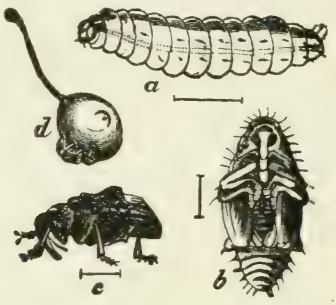

Fig. 13.—Plum Curculio; *a*, larva; *b*, pupa; *c*, adult; *d*, young fruit attacked.

injured by the feeding habits of the new beetles before they seek hiding quarters for winter. These injuries take the form of small brown circular areas about a quarter of an inch in diameter usually with a hole in the centre where the insect's

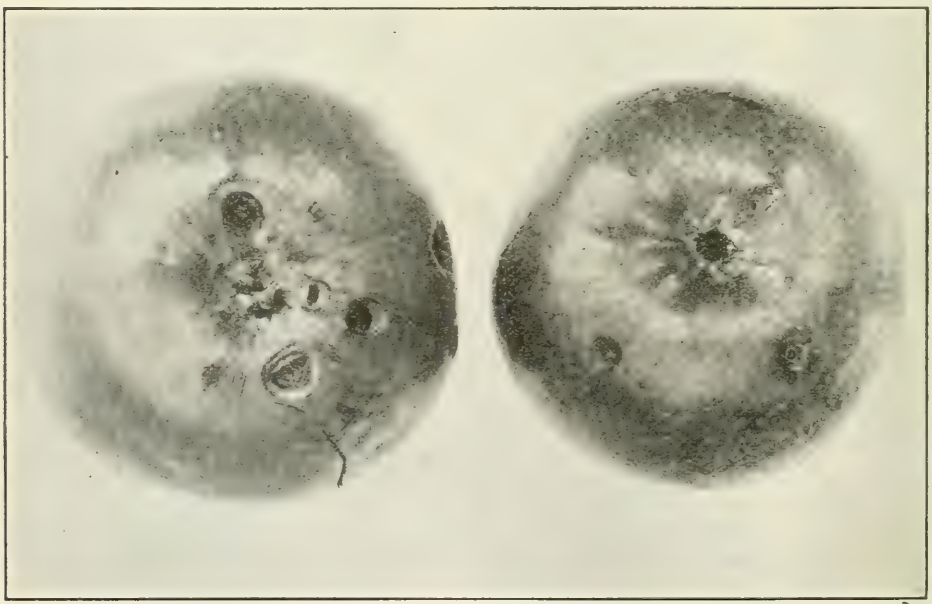

Fig. 14.—Fall work of Plum Curculio on apples.

beak was pushed through to feed beneath the skin all around as far as it could reach. Sometimes the insects enlarge these holes and get bodily into them. Orchards of any kind that are allowed to remain in sod or that have rubbish in or

around them, or that neighbor on woods are regularly worst attacked because these conditions are very favourable to the beetles especially for winter quarters.

Means of Control: The ordinary thorough spraying of apple and pear orchards with 2 or 3 lbs. of arsenate of lead just before and again immediately after the blossoms will do a great deal to control this pest but should be supplemented by the removal of all rubbish and by careful moderately deep cultivation as long as is safe for the district. Plums, cherries, and peaches should be sprayed

Fig. 15.—Black Rot Canker on apple branch.

with the arsenate of lead as soon as the fruit has set and the calyx fallen off. Usually one spraying suffices for peaches as the pubescence holds the poison, but cherries and plums should get at least a second application about 10 or 12 days later. Lime-sulphur or Bordeaux mixture may be combined with the Arsenate of lead for everything but peaches the foliage of which is likely to be burned by these washes.

Diseases of the Orchard.

The chief diseases of apple and pear orchards (we shall have to restrict ourselves to these owing to lack of time) are Black Rot Canker, Apple and Pear Scab and Blight often known as Pear Blight, Twig Blight or Fire Blight, all being the same.

Black Rot Canker: Black Rot Canker is a fungus disease that is very destructive especially along the north shore of Lake Ontario. The more I study this disease the more convinced I am that it follows injuries to the bark especially those caused by winter on trees that are somewhat too tender for the district. Those who will contrast the relative immunity of Snow, McIntosh, and Wolfe River compared with such varieties as Baldwin, Greening, and Ben Davis will be inclined to agree with me. When a dead area forms on any part of a tree and becomes water-soaked, as regularly happens, it forms an ideal place for Black Rot fungus spores to germinate. Once the disease gets an entrance these conditions also favor its growth, and little by little it spreads and attacks the healthy bark until finally the tree is girdled and all above the area dies.

Means of Control: Those who are setting out young orchards should take great care to select only such commercial varieties as are proven to be hardy enough for the district. In orchards that are established already cankers on the trunk and main branches should be cut out with a draw-knife to the healthy bark. (Only the dead bark need be removed) and the part washed with spring strength of lime-sulphur or with 1 lb. bluestone dissolved in about 16 gals. of water, and then painted over either with white lead diluted with linseed oil or with gas tar, the latter being much the cheaper but possibly a little too severe for young trees. Smaller cankers may be scraped with a hoe to remove loose bark, and then covered with tar to keep the moisture out. The exclusion of moisture is very important and often enables the tree to heal the bark all around the canker. Careful spraying of orchards at the regular times ordinarily recommended does much to keep the trees healthy and prevent canker spores from getting a lodgement. In the first application before the buds burst the trunks and main branches should be as carefully sprayed as the rest of the tree.

Apple Scab or Black Spot on the Apple: This is the most common disease found in apple orchards. It attacks both the fruit and the leaves, causing dark colored areas on the latter and the death of the part thus affected. Certain varieties such as Snow and McIntosh are much more subject to the disease than others, some of which like Golden Russet and Blenheim are almost immune. Wet and cold weather in May and early June is very favorable to the disease, whereas fine warm weather prevents its development. Apple Scab not only does damage by marking and sometimes deforming the fruit so that it is unsaleable, but also by attacking the stems while the fruit is very small and so weakening them that it falls prematurely. Furthermore it sometimes injures the leaves to such an extent that these are not able to manufacture a sufficient amount of nourishment to keep the tree vigorous and prepare fruit buds for the next season. Crab apples occasionally are almost defoliated by the scab. The spores of the disease are carried by the wind in spring to the young leaves and careful examination will show infested areas on them by the time the bloom has appeared. This fact is very important when considering control measures. From this date until a week or two after the blossoms have fallen the disease spreads very rapidly and attacks the forming young fruit, and their stems as well as the leaves. After the apples are a little larger

than a marble they are not nearly so liable to attack, probably because of the warmer and drier weather which is unfavorable to scab. Occasionally, as happened this year in some districts, there is a fresh outbreak in August and September, if the weather is wet and cool. Orchards situated along the St. Lawrence seem to be specially subject to the disease.

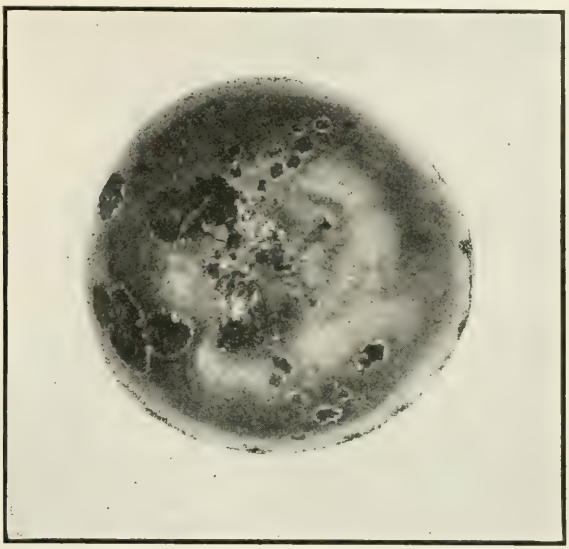

Fig. 16.—Apple Scab on fruit.

MEANS OF CONTROL: In all the main apple districts of the Province, Apple Scab is very easily controlled by a thorough application of either lime-sulphur diluted 1-30 or 40 (specific gravity 1.009 or 1.008) or Bordeaux mixture (4.4.40),

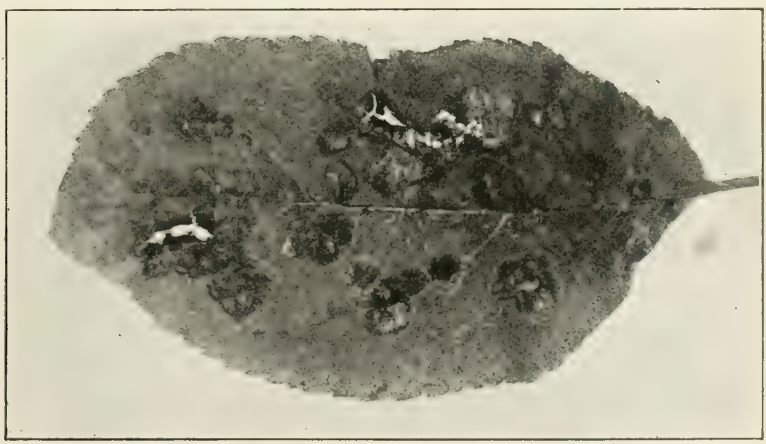

Fig. 17.—Apple Scab on leaf.

just before the blossoms burst and again immediately after the blossoms have fallen. The former corresponds to the application for Bud Moth, Tent-caterpillars and other early biting insects, and the latter to the one for Codling Moth and Plum

Curculio on the apple and pear. In districts like the St. Lawrence valley I should supplement these applications by a later one about two weeks after the Codling Moth Spray, and in seasons like this, by another about the middle of August.

Pear Scab can also be controlled by these same sprayings, but they must be very thorough, especially on Flemish Beauty pears. Lime-sulphur should be diluted somewhat more, say 1 to 45 or 50 instead of 1 to 30 or 40 for pears as the foliage is more susceptible to spray injury.

If we now sum up the spraying of Apple and Pear orchards we shall find that the average orchard only requires three thorough applications under ordinary conditions to control satisfactorily both insect pests and fungus diseases. The first of these should be with lime-sulphur (1.030 specific gravity or stronger) to which Black Leaf 40 may be added if necessary for Aphids and should be applied just before the buds burst, though if Aphids are not considered spraying may be done from one to two weeks earlier. This early application will control as we have seen Oyster Shell and San José Scale and Blister Mite and to some extent will prevent Canker. It may also help somewhat against Apple Scab.

Fig. 18.—Blossoms about to open; ideal stage for first application for apple scab.

The second application should be with 2 or 3 lbs. arsenate of lead to every 40 gallons of lime-sulphur, diluted 1 to 30 or 40 (specific gravity 1.009 or 1.008), or Bordeaux mixture (4.4.40), and should be applied just before the blossoms burst. This application will control Bud Moth, Tent Caterpillars, Canker Worms and many other biting insects, and is very important also in preventing Apple Scab and Leaf-Spot, a disease that I have not thought it necessary to discuss because of the small amount of damage is usually causes.

The third spraying should be with the same mixture as the second, but the more dilute strength of lime-sulphur should be used. This is usually the most important application because upon it depends entirely the control of Codling Moth and to a large extent that of Plum Curculio. It is also the chief application to prevent Apple Scab and Leaf Spot. Too great care cannot be given to this application.

Pear Blight: Pear Blight, Fire Blight, or Twig Blight is such a big subject that I have not time to discuss it further than to say that spraying is of very little value against it, and the proper method to follow is to watch for its first appearance

on young apple and pear trees and cut out diseased branches promptly, never letting the disease get a start on you. In cutting be sure always to choose a place nearly a foot below where the disease appears to have reached because if you do not make sure that you are below it the disease will continue to run on down. Tools should be disinfected in formalin diluted with about four times its own bulk of water for otherwise if you happen to cut through a diseased area the tools will give the disease to the next branches cut. The trees should be examined every week or so and every new case removed. Remember that insects carry the disease, and that the freer the trees are the less chance the insects themselves have to get

Fig. 19.—Pear blight; the arrows show the branches killed by this disease.

contaminated. It is doubtful whether it is practicable to attempt to control the blight in large apple trees. It is well in this case to note what varieties are most subject to it and avoid planting those varieties. (See Bulletin 176.)

Time does not permit of my dealing with the diseases of the plum and cherry. The spray calendar gives the most approved methods of treating these.

THE PRESIDENT: For Mr. Duncan's orchard at Port Hope you would say the ordinary spraying with even the commercial lime and sulphur in the spring will take care of the scale?

MR. CAESAR: I certainly think it will. I am taking it for granted that Mr. Duncan is doing very thorough spraying. By thorough spraying I mean that there is not a single twig or branch that has not been covered. There is a good deal of importance in having the strength of the mixture right. If you have your lime-sulphur diluted one to twelve or so it is pretty weak. These are seasons probably in which that will do the work, but the average season it does not seem to be strong enough. I am speaking of commercial lime-sulphur. If you use home-made you will have to go according to the formula given. There is a table given setting out how much to dilute and how to test the strength of any mixture you make. With the commercial if you dilute it about one gallon to seven gallons of water, that makes one to eight, as we call it, or one to seven as the commercial men would call it. You can put it stronger if you like, but that is strong enough to do the work. Then there are always conditions to be considered. If it rains shortly after you have sprayed you are likely to have poor results. If you spray when it is freezing you are not likely to have good results.

Q.—How strong would you have to make lime-sulphur to make it injurious to your tree?

MR. CAESAR: If you put on your lime-sulphur when your buds are not out too far, you can scarcely injure your trees if you use one gallon to five of water. You should never test in the tank. You should always work it out by rule. You cannot make an accurate test in the tank, or very seldom, because some of the previous mixture may be in there, and the sediment when it is mixed up always interferes with the test. When you are testing anything test the clear liquid before you dilute it and then work it out by rule. That would probably give you about 1.050.

Q.—If you drain your tank before you put your mixture in and then test, it may be alright.

MR. CAESAR: I never test a tank after I put in the lime-sulphur. I always work it out by rule, because I know that is correct. If you are uncertain about your lime-sulphur you can test it right out yourself by taking a small quantity and diluting it and then testing that in glass vessels. You put your hydrometer when the liquid is cooled right down to normal, and when there is no sediment, then see how far it goes down. If it reads 1.210 that is fairly weak. Now, your rule is merely this: If you want to get a strong mixture of 1.040 you divide 40 into the last three numbers, the last two figures into the last three figures. If it is 1.210 divide the 210 by 40. That will give you 5¼, and that means one gallon to make 5¼ gallons of that strength. If you want to make it 1.030 all you have to do is divide 210 by 30. But that is the time to work out your method of dilution.

Q.—Supposing you were spraying when it is pretty well out? Supposing it is a dull day and you spray and it is sometime before it dries, will it burn?

MR. CAESAR: If the spray remains on the leaves a long time without drying they are much more likely to be burned than if it dries rapidly. I think there is sufficient evidence to justify me in saying that.

Q.—Is the scale more liable to be killed?

MR. CAESAR: Yes, I should say they are much more liable to be killed.

Q.—A bright warm day is the safest time to spray?

MR. CAESAR: Yes.

Q.—Have you noticed any injury to the fruit buds by spraying?

MR. CAESAR: I have noticed a little. When the buds were on the point of

bursting I have occasionally seen on crab apples a few buds injured, and an occasional one on apple trees.

Q.—I mean from fall spraying?

MR. CAESAR: I have never done any fall spraying. I know it is practised a good deal. The New York men claim sometimes it injures the fruit buds if it is put on rather early.

Q.—Frequently it happens that you run across an orchard that you want to help during the season, and it is too late for that first spraying with strong lime and sulphur. Have you had any experience with using any of the coal oil emulsions?

MR. CAESAR: For what?

Q.—For either the Oyster Shell or the San José Scale?

MR. CAESAR: The trouble with the San José Scale, to kill the adult scale you have to make it so strong you kill the foliage. To kill the young scale you have to apply it time after time, because the first scale that is hatched is maybe forty days before the last one.

If you miss the first spray I would put on a good strong spray as soon as ever you can. I would not be at all afraid to put lime-sulphur on a badly infested orchard at the strength of one to fifteen, because it is far better to do a little injury than to leave the scale, or even one to twelve for a little while at first.

Q.—What about the Oyster Shell Bark Louse?

MR. CAESAR: That would be better controlled by waiting until it hatches out, and then give it a couple of applications either of lime-sulphur or an application of kerosene emulsion, just after it is hatched out.

Q.—We had splendid results last spring in fine warm dry weather when the buds were out an inch and a half long. It did not hurt them at all.

MR. CAESAR: I know. Mr. Biggar could tell you of an orchard he sprayed with full strength lime-sulphur when it was out in foliage, but you can't do it all the time. You can do it more easily in the early part of the season than the latter part. The longer an apple leaf has been out and becomes fully developed the weaker it tends to get, and the more opportunity there is for the spray to penetrate. While the epidermis is closer and the leaf is young there is less liability to injury.

MR. BUNTING: It is well to do it as early as possible, but if you cannot do it continue it later on in the season.

MR. CAESAR: If you cannot get at it before the buds burst go ahead and give it to it afterwards. Give it not quite so strong, but fairly strong, because the San José scale cannot be played with and you have got to spray very thoroughly.

Q.—Would you advise spraying while the trees are wet?

MR. CAESAR: No, if you spray a tree when it is wet it dilutes the spray a great deal and it does not do as effective work as it otherwise would.

Q.—Has arsenate of lead any effect on the aphid?

MR. CAESAR: Not very appreciable. Lime-sulphur will not kill them. They have taken them and dipped them in lime-sulphur. Occasionally I have destroyed quite a number, but you cannot destroy half of them. Many of our American friends and British Columbia friends say you can destroy the eggs with lime-sulphur, but I cannot.

Q.—That Black Leaf 40 is a proprietary thing?

MR. CAESAR: Yes. I am hoping we can get a tobacco of our own.

Q.—We are looking up in Essex to you to get it this year for us.

MR. CAESAR: I will do the best I can. We will get the chemists interested in it if we can. Now, supposing you do not spray before the buds burst, and yet you see the aphis coming on do not wait, saying, I think I will do it in another week, but go right at it at once. If you find they are so bad that you think they are going to do a lot of damage, then probably the handiest thing you have will be the kerosene emulsion, and give them a thorough spraying as soon as the leaves have opened or as soon as you find them threatening to be real bad. When the leaves have once got curled you cannot do anything with them. Then another thing you must remember is that most aphis on apple trees and on cherry trees will disappear in the first warm weather. This year they had all gone by the 7th July. It is true they come back in the nursery stock later on, but most of them go. If it is coming on towards July you may hope for them to disappear of their own accord.

Q.—But not without having the damage done?

MR. CAESAR: No, the damage will be done.

Q.—Would similar remarks apply to the black aphis on cherry trees?

MR. CAESAR: It is very difficult to say whether they go of their own accord or whether the lady bird beetles and such like in great numbers control them. I could not satisfy myself this year, but I know they disappeared early in July.

Q.—How do you account for the green aphis in the spring, and then along comes the rosy aphis? Where were they in the spring?

MR. CAESAR: The rosy aphis were there, but not very many. The speed of reproduction borders on the miraculous. If I were to tell you how rapidly they multiply you would say I was the worst fabricator that was ever found in this hall, so I will not attempt it.

Q.—Do you use molasses or glucose for the curculio?

MR. CAESAR: It doesn't seem to have any value as far as we could tell. This year there were quite a number of tests made and it did not seem to have any additional value. Quite a number reported they could not see any difference.

For apple scab you have to spray thoroughly. It would have been desirable in most districts this year on account of the wet season to have sprayed again about the middle of August. In fact I recommended any person who asked me about it to give an application about that time. In the St. Lawrence River Valley I would recommend four applications in the spring, the fourth one about two weeks after the spraying for the codling moth. Then I would recommend another application in the fall of the year, around the 10th of August, because it is a very difficult problem to control it. Once it gets into the leaf or into the fruit your lime-sulphur will not destroy it.

Q.—Will it prevent it from growing any larger?

MR. CAESAR: No, once it enters through the epidermis you cannot prevent it. You can prevent it from going to other parts. It is when the blossoms open that you get the scab on the leaves, and if you get them before they have opened you cover over your leaves with something in which the spores cannot grow.

Q.—Lime-sulphur or Bordeaux mixture?

MR. CAESAR: I do not think there is any difference.

Q.—You spoke about the canker, and the trees not being hardy enough causing it. In the past season I have had some experience with trees in a place where they are not inclined to be hardy, on Manitoulin Island and I have not yet seen any of these black rot cankers. In what way does that spread? For instance, they are bringing nursery stock in, and why has it not yet appeared?

MR. CAESAR: It does not spread as a rule from nursery stock. It may spread from apples brought in that are affected. When an apple begins to decay you get what they call a hard rot. The apple first begins to look brown, and that is really the black rot disease in the apple. That apple will turn black and get little pimples all over it. Fruit brought in that is infested and thrown out would be a means of spreading it. In the nursery stock if there are dead twigs or dead parts of the trunk it may get a start in that dead wood, but not very likely. I am rather surprised you are not finding it up there.

Q.—Has the planting of fruit trees along a windbreak in an orchard anything to do with that ink spot?

MR. CAESAR: Yes, by the prevention of the circulation of air and light.

Q.—I know an orchard in our community and if there is any ink spot in the country that orchard gets it, and it is worse along by some spruce trees.

MR. CAESAR: Yes, those spruce trees are liable to favour apple scabs. Anything that prevents the circulation of light and air is favorable to any of these diseases.

Q.—You would not advocate doing away with them altogether?

MR. CAESAR: I do not know that I would express an opinion on that. Unless you have got an orchard in a very exposed place I would make my first row of apple trees serve as my wind break. If I thought that wasn't enough I would put another row. I do not like wind breaks myself except in very exposed places or in very cold climates.

Q.—You would not recommend a wind break, but if you had one?

MR. CAESAR: If I had one I would try to counteract it by spraying, because we all love a beautiful wind break. With good spraying you can overcome it in almost every district I think.

THE PRESIDENT: Do you know anything about dust sprays?

MR. CAESAR: They were tried out a good deal a few years ago and they have dropped out almost entirely as being inferior to the ordinary wet spraying.

Q.—Take orchards that are headed back or cut back near the limb so that a good current of air can get through, do you find many of them much affected with ink spots even this year?

MR. CAESAR: I cannot answer that because I have not been around enough to see, but that would be a condition favourable to keeping apples free from ink spots.

Q.—What is the best means of preventing pear blight?

MR. CAESAR: That is a big question. There is only one thing to do with pear blight, and that is act quickly and keep on acting. Pear blight starts in the spring of the year when the blossoms are open, and that is the time it is carried, especially to apples. On large apple trees I doubt if it is at all practicable to attempt to control it. You should try to control it on young apple trees, because it may spoil your young apple trees altogether, say from one year to ten years of age. With pear trees you can control it fairly well in most seasons. Now, pear blight starts with the blossoming time. You can see that easily if you go to an apple orchard. You wonder what made that branch die, and you go to another tree right by it and it is not badly affected at all. If you look at it you will find it is the twigs with the blossoms on that are dead with blight. It is something and it must be the blight. It is carried then at the time of the blossom, and you will not see the effect of it for nearly two weeks afterwards, because it develops very slowly at first. Then it will spread throughout your orchard from

diseased parts to healthy parts by means of insects. Now, if you want to control it you want to have as few twigs as possible for the insects to feed on and get contaminated therefrom and carry it off to the others. For that reason one should watch in the early part of the season and cut out every twig that is affected just as soon as you see it is affected, because it will run right down those twigs, especially on pears and on tender young apple trees and crab apples. So cut those out as soon as you see they are affected, and always cut quite a little distance down below, and disinfect your knife or your pruning callipers by dipping them into a solution of one part formalin and four or five parts water. That is the cheapest substance I know of for disinfection. If you cut them out at the early part you are giving the insects a poorer chance to get infested than if you leave them quite awhile, and you will find many other twigs that you did not expect were affected, and you will be discouraged. The whole thing comes down to this: Cut out the pear blight as soon as ever you see it in your pears and young apple trees, and cut well below, and disinfect your tools, because if you cut a diseased part and then cut a healthy part you are almost sure to give it the disease. You can put ten thousand of those things on the head of a pin. If you go through your orchard from time to time, every week or so, they would get fewer and fewer each week.

Q.—Why not cut it out of the big apple trees?

MR. CAESAR: You cannot get the time.

Q.—Have you introduced the bacteria into healthy limbs?

MR. CAESAR: Yes, frequently. It has been done hundreds of times. You can take your knife out and do it any time you want to.

Q.—Didn't you say at one time you could use coal oil to disinfect it?

MR. CAESAR: Coal oil would disinfect but formalin is nicer. It is not so hard on the tissues.

Q.—How can you tell whether the aphids are going to be bad?

MR. CAESAR: You cannot tell, because 99 per cent. of them in the ordinary season will be dead before next spring. You cannot tell whether it will be bad next year or not. Out in British Columbia it is the greatest pest they have got.

MR. CAESAR: There is one thing I would like to mention. I am hopeful that we will have a new poison cheaper and better than arsenate of lead in a couple of years. I tested one out this year, an arsenite of zinc, a much nicer poison to work with and saves a great deal of time, and besides is considerably cheaper. It stands up better in the water, and it does not take near so much agitation, and sticks just as well as the arsenate of lead, and no damage whatever to the foliage. However, one year's experience is not a sufficient test, but it gave quite as good results as the arsenate of lead, and we thought a little better. It was tested on a very large scale at Hamilton, by Mr. Beck, and Mr. J. E. Smith tested it a little, but not sufficiently to amount to very much. We intend to test it again next year. I would not advise you to go into it until we try it another year. If it is going to work out as we think it is it will be a good thing and I think one of our chemical companies will take it up next year and manufacture it, and if it is sold as cheaply as it is sold in California there will be a considerable saving in money and a considerable saving in time.

Q.—What was the cause of our apple trees dying last year?

MR. CAESAR: The severity of the winter. It was a case of the trees that bore heavily not being hardy enough to stand it.

Q.—Could you make the lime-sulphur very weak and get the same results with the rot?

MR. CAESAR: Not very well. If you make it one to fifty you make it too weak for the rot.

Q.—We find a great deal of leaf spot from that on our trees?

MR. CAESAR: There is one point I would like to mention. A pretty good test was made by Mr. E. Henry and his son. I asked him to make some tests on the effectiveness of lime-sulphur on plum trees for rot. He tested it this year and it was a pretty good year for rot, favorable for it. He told me in his opinion the lime-sulphur gave better results this year than the Bordeaux mixture. Both of them gave clean plums, but the foliage was decidedly better where the lime-sulphur was put on. I attribute this to the fact that the red spider was exceptionally bad this year in the Niagara district, and in some orchards the leaves looked the color of dust, that hazy brown color. The lime-sulphur would control those by having it about one to forty for the ordinary season. On the Japanese plums it would be better to use the Bordeaux mixture.

Q.—About what proportion of arsenate of soda do you use?

MR. CAESAR: That is better not used at all on fruit trees. Arsenate of soda cannot be used with lime-sulphur at all, but it may be used with the Bordeaux mixture. The arsenate of soda will burn everything if put on by itself. I have burned trees and taken every leaf off.

Q.—I did not last year by using plenty of lime.

MR. CAESAR: I know man after man who has used it and had no burning, but again there are cases of most severe burning, and therefore we cannot recommend it.

TRANSPORTATION PROBLEMS.

MR. G. E. MCINTOSH, TRANSPORT AGENT OF THE ASSOCIATION, FOREST, ONT.

In introducing the subject of transportation as applied to the great industries of fruit and vegetable growing in the Province of Ontario, I am conscious of the fact, and I believe the growers are also conscious of the fact, that transportation with all its problems, is one of, if not the most important of all constituents, which go to make either of these industries a success for the producer.

In the case of fruit you may prune, spray, cultivate and practice every precaution in the picking, packing and loading, but just as soon as it passes into the care of a carrying company, be it railroad or steamboat, it rests with them just in what condition the fruit will appear on the market. Transportation is therefore, probably the most important factor in the "make or break" of the great fruit industry of Ontario.

It was with a realization of this that the joint Transportation Committee of the Ontario Fruit Growers' and the Ontario Apple Shippers' Associations, have begun an aggressive campaign along the line of securing better facilities and improved conditions in many ways for the proper handling of fruit from the Railway and Steamboat Companies. The Committee having this work in charge is composed of men of wide experience; men, whom I am satisfied will give this great problem the close study it demands, and eventually force improvements.

To the many whom I have interviewed, I wish here to express my appreciation for the kindly manner in which I was received, the interest manifested in my work, and for their willingness in giving any information within their power to

facilitate the gathering of all possible data. The question of transportation is indeed a very great one—may I say a life study, and I realize that you gentlemen having years of experience in dealing with the carrying companies, know very much more about existing privileges than I could hope to learn in the short time I have devoted to this work. I will endeavor, however, to outline as briefly as possible some of the conditions I have observed, and to call your attention to a few of the outstanding features which have impressed me most strongly, also to briefly place before you a synopsis of a portion of the facts gathered supporting certain requests for improved conditions submitted to representatives of the different railways.

That just grievances against the railways exist is a certainty, and the efforts of the Transportation Committee to remedy some of these have been useless from the fact that the weakest point of the average shipper to-day, is not keeping specific data of all shipments. The Railway Companies, however, will very soon find this condition of affairs will be changed, because the shippers are now seeing the importance of such, and we hope from forms sent out to be able to meet the railways with a compiled report of the moving of the entire fruit crop of the Province, condition of cars, delays, etc.

Delays in Transit: The Railway Companies have been asked to provide a minimum rate of transit for apples by freight in carloads, of ten miles an hour. Certainly not an unreasonable request, yet from figures I have compiled and from records received from shippers, it appears the average rate of transit on western shipments is considerably below ten miles per hour. One shipment to Moose Jaw, 1,633 miles, did not average three miles. Another to Calagary, 2,071 miles, a trifle better than four miles per hour. Others to Saskatoon, 1,714 miles, just three and one-half miles per hour. Another to Regina, 1,591 miles, not quite six miles per hour. One to Winnipeg, 1,234 miles, three and one-third miles per hour, while the average on fourteen carloads from different points to Winnipeg, was scarcely seven miles per hour. One shipper alone reported to me on eleven carloads to Winnipeg as follows:

1 car	7 days
2 cars	8 days
1 car	9 days
1 car	10 days
1 car	13 days
1 car	14 days
3 cars	15 days
1 car	16 days

The losses sustained by these shippers averaged from $125 to $330.

While this is a most serious state of affairs, it is going to entail no end of trouble to have it remedied, because of the fact that the Railway Board has repeatedly held that where application has been made to them for redress or losses sustained by delay in transit, they have no power to award damages for the delay; that the remedy of the party or parties aggrieved was to be found by action in one of the regular courts. It follows then that the fruit growers can look for no improvement in this respect until by a submission of facts relative to the moving of our whole crop or the greater portion of it at least, we can prove to the Board the necessity of an investigation for the purpose of devising a remedy for a defective system.

Delays in Getting Cars: A request has been made that when Railway companies fail to furnish suitable equipment for the transportation of fruit within

three days, after an order is given, they become responsible for direct or indirect loss caused thereby. Many growers and shippers have suffered considerable loss in this respect. Last season the shortage of cars was experienced by nearly every shipper, but it is an outstanding fact that the greatest difficulty in getting service was at non-competitive points. Shippers, whose names I will not mention here, waited two weeks for refrigerator cars, and eventually were forced to use box cars. Under such conditions, with the shipper liable for demurrage after holding a car a certain length of time, it seems only fair that when the railway companies cause loss to the shipper by not supplying cars in a reasonable period, they also should become liable.

Reports of Cars in Transit: The difficulty in this respect seemed to centre in not being able to get reports from local agents, the shipper having to apply as a rule to divisional agents, and at some expense. The railways have recently consented to give this information daily, and without charge, by application to the local agent.

Completing Part Carloads in Transit: This is a privilege (the importance of which is well known to every fruit shipper) that is now standing before the Railway Commission. We ask simply to be put on a fair competitive basis with the fruit shippers of the Okanagan district of British Columbia, who enjoy an inward freight minimum of 10 cts. per 100 lbs., or a similar privilege to that granted shippers of horses, cattle, hogs, sheep, live poultry, grain, canned goods, lumber and poles, who can ship part carloads at carload rate and weight from point of shipment to destination, and stop for completion of load for $3. The fruit industry the present season has suffered greatly, especially in the newer districts, because of not being able to ship in carloads, and had to market at evaporator or canning factory prices. Under present conditions there is no special provision whatever for completing carloads of fruit in transit, although in some districts 75 per cent. of the entire crop has to be assembled at a central point by teaming or by paying an almost prohibitory local rate, and then compete in the western market with B.C. growers, having privileges we do not get.

We are conscious of the fact that railway companies wish to encourage shipping in all commodities, and are showing favor or preference to those we have mentioned as enjoying this stop-over privilege, given at a time they tell us when they were infant industries, to encourage carload lots. Will it not have the same effect with fruit shipments? Most certainly. The tonnage of fruit is to-day considerably less than grain, live stock or lumber.

In 1907 the railways carried 5,776,731 tons of grain, and in 1911, they carried over 7,000,000 tons; live stock over a million tons, lumber over seven million tons, and fruit and vegetables 957,237 tons. I submit these figures to show that if the granting of this privilege in the case of live stock, grain, etc., has been done to encourage shipping of such, and to the canning factories as an encouragement to an infant industry, then the fruit shippers, handling a highly perishable article, and paying a rate much higher than on canned goods, double that of live stock, two and a half times that paid for lumber, three times the rate on grain and four times greater than on poles, should have equal advantages. We base our claim on the absolute necessity of some such privilege to enable the Ontario growers to get the best markets at the proper time, and finally we base it on Section 317 of the Canadian Railway Act, sub-section 3, which reads, "No Company shall make or give any undue or unreasonable preference or advantage to, or in favor of any particular person or company, or any particular description of traffic, in any respect whatever."

Shortage of properly equipped refrigerator cars—from statistics gathered, there is no doubt that the railway companies are not keeping pace in the supply of rolling stock, with the development of the country, and that the existing refrigerator car service is unsatisfactory. There are several instances, notwithstanding all the care taken by the producer of fruit to select and pack his fruit in a careful manner; that when it is handed over to the railway companies it is done at a very great risk. It is not an unusual occurrence to order cars with heaters, and they arrive without heaters or heaters of no use, out of repair, cars open, and without slatted bottoms, or probably have to accept box cars, line and slat them. Shippers, however, are compelled to make all such repairs to safeguard their shipment, without any recompense from the railways. The expense to some being as high as $200 annually.

The late Chairman of the Railway Commission, Judge Mabee, when hearing the complaint of the grain shippers clearly set forth the fact that a shipper should not have to fit or repair a car for his goods, but that the railway company should supply a car suitable for the carrying of his shipments, and the Board accordingly ordered that the companies pay shippers who furnish grain doors for box cars from 50 cents to $3.00; live stock shippers who supply planks and spikes for doors $1.25, and shippers who supply doors in certain cars for the shipment of coal, from 50 cents to $3.00.

We all appreciate the difficulties the railway companies are in, in the way of keeping cars in proper condition; but after all, this is one of the burdens that the carrier has to bear, and it should not militate against the shipper.

The statistical facts reveal a state of affairs in regard to refrigerator car service that is surprising. Accurately comparable data supplied by the Minister of Railways and Canals, from sworn returns furnished by the railway companies shows clearly that the companies are not supplying a refrigerator service equal to the development of the fruit industry or the demand of shippers of perishable freight. It is a surprising fact that one of our principal railway companies has to-day 10 refrigerator cars less than they had four years ago, while the tonnage of fruit and vegetables carried by the company has steadily increased. The total refrigerator car equipment of the three principal carrying companies operating in Ontario, the G.T.R., C.P.R., and C.N.R. in 1908, was 2,040, and on June 30th, 1911, it was 2,409, a very small increase compared with the increase of fruit and vegetable shipments on these lines from 429,930 tons in 1908, to 607,478 tons in 1911.

Storage: Accommodation for the storage of fruit, particularly peaches, plums, cherries, etc., awaiting shipment is another important matter, and one which is quite inadequate, except in the older fruit districts. It is apparent as the Act now stands, orders for improved facilities for handling express traffic can only be made against the railway company. The Railway Board has no jurisdiction to compel express companies to use a particular class or kind of car, or to provide shelters at points of shipments or destination. This apparently is a complaint which should be lodged against the railway company, and is a matter which should be dealt with at once, at some shipping points.

The late Chairman of the Board said: "If express companies do not provide for car service, shelters and the like, with the railway companies over whose lines they operate, and remove all proper cause of complaint, then it will be the duty of the Board to deal directly with the railway companies as to these matters, and complaints from the public must be made against them."

Claims: A great many shippers throughout the Province report considerable difficulty in getting reasonably prompt settlement of claims for damages caused by negligence on the part of the carrying company; the costly manner in which disputed claims have to be settled by recourse through the courts; and the "wearing out" procedure of the companies in delaying these settlements, is costing the fruit shippers thousands of dollars. Many prefer to drop their claims rather than follow the only course now open to them for collection. Losses by pilfering are also many, but where this loss comes back to the shipper, it might be well to point out the fact that he alone is responsible. He has the right to demand a clear bill of lading for his goods, (without notation "Shippers' Count—more or less, etc.,") for the number of packages loaded, provided that before commencing to load he notified the agent or his representative, that a clear receipt will be required. Strange to say, however, of the total number of shippers called upon the past season, only 18 per cent. knew they had this privilege.

Again the Commission has ruled that they have no power to issue an order in reference to rough handling and pilfering, but is a matter that must be dealt with by the shipper or receiver under civil law in an action for damages.

The Railway Commission is a Governmental agency of real authority and a Federal tribunal of far reaching influence and power—A "friend at court" of the public, but after all instances as here outlined, establish the fact that having no jurisdiction over such subjects as settlement of damages, jolting, rough coupling, delays and pilfering, there is a need of extending their power, especially in the matter of claims; power to adjudicate on claims standing over say six months, and to settle damages caused by unreasonable delays, such as I have pointed out in our western shipments. The Board, however, affords every opportunity for the shipper to prosecute his claims however small, that may come under their jurisdiction, and provides a tribunal for the determination of transportation questions without costs to the parties. The individual shipper has by course of law been transformed into the general public. The carrier has by like process of law been transformed into a public agency; to which we may add that in the great game of railroading, the Railway Commission has by course of law been transformed into the umpire. They give a fair deal so far as within their power, but legislation should extend their jurisdiction.

Marketing: There are two principal difficulties that must be overcome, the excessive express and freight charges, especially west of Winnipeg, and the present system of distribution. There are some markets that are now being supplied by express which can be reached just as quickly by freight, but here again the delays in placing cars makes the unloading time too uncertain to take the chance.

In regard to distribution, more particularly in districts where growers have not organized; fruit is sent on commission to all cities in Ontario and some western points. Market reports are circulated of some markets that are higher than others and these places will receive large shipments, with the result that they are flooded and prices lowered, perhaps never to recover for the season. This is the results of growers shipping independently, not knowing what each other are doing, yet all shipping to the same market, and while this market is being overstocked, others are not getting their requirements.

I would strongly urge the advisability of closing following conditions at the Canadian Soo, for at present it looks as though that market, which is a rapidly growing one, will be one of those lost to the Ontario grower from American competition, if better freight service is not restored, and better rates given. The

present season, the Northern Navigation Company would accept freight for that port only one day a week. This had the effect of forcing the dealers to buy American products, and practically shut the Western Ontario fruit counties out of that market. I was surprised while there in August to learn that large dealers had placed apple orders with growers at Lyons, New York, and landed early varieties at the Soo for 42 cents a barrel freight, as against 60 cents freight for Ontario apples, and that they could bring them from Illinois and Ohio for 22 cents per cwt. The day I was there, 1,000 bushels of Elberta peaches were bought at the American Soo for $1.25 per bushel, and were supplying the market in the Ontario Soo. The American fruit and vegetable dealers were not slow in taking advantage of the existing freight conditions in their favor this season, as a Minneapolis firm were then erecting a large warehouse at Sault Ste. Marie, Ontario, for the handling of American fruits and vegetables for Canadian consumption. This condition of affairs was a serious matter for the growers of Lambton and Essex Counties, particularly the former, where the industry is only in its infancy and carloads at any one point is an impossibility. They depended on the Soo market, and by shipping through a Sarnia dealer gave the Soo buyers the benefit of the carload lake and rail rates at 20 cents per cwt. on vegetables, 38 cents on fruit and 25 cents on apples, and the quick despatch of 20 hours. It was my privilege to place these facts before the Board of Trade at Sault Ste. Marie, who later took it up with the officials of the steamboat company, with the result that they have looked into the matter and report that they purpose next season to have a new dock with sufficient facilities to resume the freight service.

I regret that the short time at my disposal will not permit me to deal with some important matters relative to marketing at Port Arthur and Fort William, suffice it to say that there is very great need of inspection at point of shipment for all fruits going into these markets.

Freight and Express Rates: The rates east of Winnipeg have appeared to be fairly satisfactory, but at these points, where the Ontario grower is brought in close competition with the American grower, the question of rates is a very important one. Mr. Cannoss, of the Fitzsimmons Fruit Company, Fort William, said: "The freight rates on American roads are so much lower that I was able to buy June tomatoes from Texas, pay the freight and duty and sell them at $1 and $1.20 per crate of 20 lbs.

The following few comparisons bear out Mr. Connoss' contention in a somewhat surprising manner:

Minneapolis to Sault Ste. Marie, Mich., 494 miles, carload rate, fruit per 100 lbs.	30 cents
Forest to Sault Ste. Marie, Ont., 325 miles, carload rate, fruit, 169 miles less haul	54 cents
Chicago to Sault Ste. Marie, Mich., 673 miles, carload rate, onions, per cwt..	22 cents
Forest to Sault Ste. Marie, Ont., 325 miles, carload rate, vegetables, per cwt., 348 miles less	26 cents
Grand Rapids to Sault Ste. Marie, Mich., 415 miles, carload rate, vegetables, per cwt.	25 cents
Forest to Sault Ste. Marie, Ont., 325 miles, carload rate, vegetables, per cwt., 90 miles less	26 cents

The above rates from points named to Sault Ste. Marie, Port Arthur and Fort William, though but a few instances, show that the rates levied upon fruit and vegetables even east of Winnipeg, are sufficiently high to drive the Ontario

product out of some of the best markets and create a demand for goods imported from our neighbors to the south. What is being done at these points is also extended to points west of Winnipeg, where Ontario fruit burdened with an excessive freight rate, is brought in competition with British Columbia fruits, especially in Alberta and Western Saskatchewan, and also with Nova Scotia apples, and some from Washington and Oregon. British Columbia fruit shippers recently appealed to the C.P.R. for a reduction of rates to this market, resulting in the following reduction on apples:

Kamloops District to Calgary.....	from 70 cents to 62 cents
Okanagan District to Calgary	from 70 cents to 60 cents
Spence's Bridge to Calgary.....	from 80 cents to 68 cents
Okanagan points to Medicine Hat.....	from 75 cents to 71 cents
Spence's Bridge to Medicine Hat.....	from 85 cents to 79 cents

This reduction means a saving of $24 a car, from Okanagan to Calgary.

A further reduction was also granted from Okanagan to the Coast, on apples and fresh fruits, the former from 45c. to 40c. per 100 lbs., and the latter from 53c. to 48c.

C.P.R. and G.T.R. tariffs becoming effective April, 1912, show some reductions on rates for apple shipments from Ontario to Western points, but they are not yet on a fair basis; the most noticeable reduction is that of Edmonton, 2,079 miles reduced from $1.15 to $1.04. Comparing even this with the $1.03 from Berwick, Nova Scotia, to Regina, 2,787 miles, a haul of nearly 700 miles farther and at a less rate; it does look as though there is yet room for some further reduction.

Another instance: A carload of apples can be shipped from St. Catharines to Winnipeg, 1,234 miles, for $127.20, but to haul it 480 miles farther to Saskatoon, the additional charge is $91.20.

The above comparison might also be applied to express rates.

A carload of fresh fruit shipped by express from the Niagara district to Winnipeg would cost on 20,000 lb. minimum, $530.00, but to haul it the 480 miles farther on to Saskatoon, the charge would be $880,00 or $350.00 extra for the additional 480 miles.

Another glaring example of the unjust manner in which express rates are levied is between Forest and Winnipeg. In the case of Sarnia they have an express rate of $2.90, whereas Forest shippers, 23 miles less haul, are assessed $4.40 per 100 lbs. to the same point.

Calgary to Winnipeg: If these rates both freight and express were made more reasonable for the Ontario fruit and vegetable grower it would undoubtedly stimulate western trade.

I have endeavored to outline briefly some of the fruitmen's difficulties in connection with transportation, and some of the recommendations of the Transportation Committee for improvement of such. There are many other matters suggestive of improved conditions that I am not permitted to deal with in this paper, but there is one most important suggestion I wish to drop before closing. It is in regard to the handling of export shipments at Montreal. There is a very great need of either making our fruit inspectors there also cargo inspectors, or have a special inspector for the purpose of seeing that your apples are given at least reasonably careful handling.

You growers are by legislation, and subject to a fine, compelled to take every conceivable precaution and care until your apples are on the cars. Why, then,

in common justice should our Government not make these men handling them at the export points responsible to a Government official. Can you imagine the effect of piling boxed apples on the bilge? If you can, you can perhaps have some idea of my feelings when I saw, two weeks ago, nearly two carloads so piled in one of the sheds at Montreal. I venture to say, and with all due respect to the steamboat companies and to the railway companies, too, because fault lies with both, that some of the handling I witnessed would render the apples practically unsaleable. I am satisfied that fruit inspectors stationed there are doing their very best under the circumstances, but conditions there must change. This is a matter that your Transportation Committee will probably deal with later on.

In conclusion let me say, it is the little details that every shipper should watch in order to secure minimum rates and maximum privileges for transporting his goods. One of the most common errors is to neglect the shipping end of a business, while probably nowhere could a few hours be spent more profitably than in studying the secrets of the classification and the tariff sheets.

I trust the work begun by your Transportation Committee will go on: that they may have as the goal of their ambition in this work the unravelling of all transportation problems, and a persistent attack for the rights of the fruit shippers of Ontario. This will not be accomplished at one time, but continuous efforts must bring results. The assistance, however, of every grower and shipper must be enrolled, and when that is accomplished the railway companies and the steamboat companies will have a power behind that will force a reasonable solution to present day transportation problems.

May I conclude this paper by urging you to interest yourselves in this great work. In unity there is strength.

Mr. Geo. Robertson, St. Catharines, stated the case of his shipping by Canadian Express 40 baskets of cherries consigned to John Caldwell, Montreal: that they were delivered late in the afternoon and sold for about two-thirds of what they should have sold for in the morning.

I put in a claim, and I have the reply in my pocket from the Canadian Express Company, asking me to withdraw the claim as the Grand Trunk train had been delayed some hours and minutes at Newtonville, and it was out of their control. I intend to reply to them and tell them I will keep their reply as a souvenir, and hope it will aid in rectifying some transportation matters in future. The stuff was sacrificed at two-thirds of its value and I put in a claim for the difference. (Reads letter).

Mr. McIntosh: The Railway Commission should have power to deal with such matters. They claim that it is out of their jurisdiction entirely. That is one of the points I fell like pressing before this meeting, that there should be legislation to extend the powers of the Railway Board to this extent, to adjudicate on all claims standing over six months. I know of instances of shippers who have waited five years, and I have no doubt this gentleman will have to wait quite a while for this claim.

Mr. Armstrong: I think Mr. McIntosh deserves a very hearty vote of thanks from this Association for that report. As an old member of this Association I never remember listening to such an elaborate report as I have just heard read by Mr. McIntosh.

The President: I am sure Mr. McIntosh deserves an expression of our thanks. He has worked hard at this work. It is a huge question and one very far reaching. Mr. McIntosh has devoted himself very carefully and thoroughly

to the work. Those in favor of this motion will express it by the raising of their hands. (Loud applause).

Mr. McIntosh: I assure you I appreciate this vote of thanks very much. I will endeavor to get the very best results possible.

NURSERY STOCK—ITS SELECTION AND CARE.

J. W. Crow, Horticulturist, O.A.C.

I wish to address myself particularly to one point in connection with nursery stock, and do not propose to occupy your time with a full discussion of the subject including the care of the stock. I want to speak regarding the question of one year old trees, or rather the question of low-headed trees. It is rather a leading question with the nurserymen, and it has come to be a much more important question with many of the more up to date fruit growers. Now, for myself in planting an orchard I would want a low-headed tree, and for my own purposes do not care how low it is. I would be satisfied with a tree that had a trunk, say one foot long of even less. That will be considered radical by many people who are accustomed to trees with five or six foot trunks. I do not see what use a tree has with a trunk more than one foot or eighteen inches at the most. You can modify that if you wish. When you go to a nurseryman to select a one-year-old tree you will have difficulty in finding a tree that is low enough to suit the requirements mentioned. Nursery trees usually have a trunk of about two feet or two and a half. That is about the best you can do; and a great many are headed so you cannot get that. Under present nursery conditions, if you want a low-headed tree you have to buy a one-year-old tree. You can head that off any way you like and grow a head to suit yourself. Now, the nurserymen object rather strongly to the necessity of digging one-year-old trees. They do not like to dig them or sell them, and from their side of the case they know what they are at; but at the same time, I believe there will be a growing and increasing demand for this class of stock. Now the question is, what are we going to do? The fruit growers want them and either some common ground must be found somewhere on which they can meet or one side or the other is going to give in. Personally, I think there is a way out of it. If nurserymen would head all their trees uniformly low, it would be possible to satisfy every purchaser, for the simple reason that the man who wants a low-headed tree could get it say at two years or three years of age, and the man that wants a medium high-headed tree could cut off some of the lower branches and get a medium high-headed tree, and the man that wants a tree headed a little higher can get that tree simply by removing some of the lower branches. I can illustrate probably a little better what I mean. Here is a fair sample of an ordinary two or three year old tree. You cannot lower it except by planting the tree in the ground too deep, which I think would not be advisable. To get a low-headed tree you cannot cut that tree off and re-head. That is not practicable except in a few cases. To get a low-headed tree you have simply got to buy that kind of tree. Here is a one-year-old apple that is strictly first-class, and at the same time our nurserymen object to digging trees at that age. They would rather not sell it. A grower buying stock like that can head it where it suits him. A nurseryman will head it about there, and have a tree next year about like that. A fruit grower will head a tree as low

as he likes and get any style of tree he likes. The nurseryman would head it about where I have my hand—about two and a half feet from the root. This is a one-year-old. I use that for illustration purposes. This will show exactly. Suppose that tree had been headed low, to get a higher tree simply take this off, and there is the tree. It is simple to head a tree higher, but it is harder to head a tree lower. In five years time, it does not make a particle of difference. You can cut off every one of these and have a straight tree. You can take that off and have a high-headed tree if you want it, or take the other one off and have a high-headed tree. It occurs to me if nurserymen would head their trees low down everyone would be satisfied, because the purchasers could get anything they wanted. There are people who want a tree with a four foot trunk, and fruit growers and the members of this Association ought to educate the people who are not informed and teach them better than that anybody should want a tree with a four foot trunk. Some people do, but I think it is an entire mistake. I would like to hear discussed, whether it is practicable for the nurserymen uniformly to head their trees lower. What do you think, Mr. Smith?

Mr. Smith: I think every nurseryman would be delighted to do it if the public wants it. The difficulty is that perhaps 75 per cent. of those who buy off the nurseyman want a high-headed tree, and we must cater to the wants of those who buy our goods. If you can only train those who buy trees that that is the way to do it, it will suit the nurseryman splendidly. We would like to grow a low-headed tree, because it is cheaper to do so. Some people—educated fruit growers—want it low, and perhaps those not so well educated want it higher, so we have to grow what the people want, and it is a pretty difficult job, and I wish you could solve it for us.

Mr. Crow: I sometimes wonder how much influence a nurseyman might have in training the public to the proper kind of fruit trees to plant. I think the majority of people take the nurseryman's word, and the nurserymen, if they care to do, can go a long way to getting people to use a low-headed tree. Why not have the nurserymen combine, and get them all down to a low-headed tree.

Mr. Smith: If the nurserymen realize the influence they have upon the public, I would like to get back at you—do you realize the greater influence that you have on the public over nurserymen. When we make that suggestion people say, "You are trying to sell your goods." But you are in a position where you can influence public sentiment a great deal more quickly and rapidly than the nurserymen. You gentlemen who are interested in the better culture of trees, if you make a public statement to the people and explain in your reports and in your published addresses that the nurserymen are trying to produce a better tree than they have in the past, by getting them lower, you will aid the nurserymen very materially. At present there is an established rule in regard to trees. The catalogues put the trees from five to seven feet. Now, if you head your trees lower, you must reduce the height of your trees in your catalogues and reduce the price. I don't think nurserymen would raise the slightest objection about educating the public to lower-headed trees, because it indicates a more simple process.

Q.—Don't you think with some varieties you would not succeed very well in heading then low. Take the Golden Russet. I have a Golden Russet that will measure thirty-five feet across the tops and you would have them dragging on the ground. And take the Wolfe River, you cannot get that high enough.

Mr. Crow: There is a difference in varieties, but the difference in varieties is not so much as to effect the general problem.

In so far as the influence of myself and other men who are in the same line of activity is concerned, it is probably correct to say we have more or less influence with the public, at the same time, I believe the nurserymen have a great deal of influence as well. How would it be if the nurserymen and the professors, as you call them, would work together. Don't you suppose we could prevail on the general public to buy and use and be satisfied with lower-headed trees.

Don't you think that if the nursery agents had low-headed trees to sell they could find arguments in favor of those which would probably induce a large number of buyers to take them?

MR. SMITH: I think there is a point in regard to this that is being overlooked. A very large portion of the market of nursery stock is outside of fruit growers, and when you go to a farmer who knows comparatively little about trees and fruit growing and tell him you have got a three-year-old peach tree to sell for twenty cents and a one-year-old for fifteen cents. He will take the three-year-old every time. He wants size. Another point in regard to the height of a tree, they want to get their horses under it. They don't know how you are going to plow under those trees. I don't think it is possible to do business with that class of customers and sell them the article that the fruit growers want. I don't think it is possible. It is simply a case, if it gets down to that, that he is not going to have it—he is going to cut it out.

Q.—What do you mean by a high-headed tree? The stem is about two feet six inches, I suppose, or thirty inches. You recommend about one foot six inches as I understand it or even lower. Suppose you take one foot six inches, the difference is one foot. Now what great difference is there going to be in that tree when it grows up, whether the limbs are six or seven feet from the ground, or whether five feet or four feet. There is only one foot difference in the trunk of that tree. And if the difference in the trunk makes the difference in the height of the tree ultimately, then there is only one foot difference in the height of the tree.

MR. CROW: If you take the case of apples, and you have to hire men to pick apples, you know that every foot a picker has to climb up a ladder adds to the cost, and it takes just that much more money and it adds to the cost. You will find there is a difference of dollars and cents if you take into calculation the extra foot you have to climb.

A tree can be low-headed with a trunk of six feet. It is largely true that the form and height of a tree may be determined after planting. I think, however, that a low-headed tree offers much greater facility for the proper training and proper forming of the tree than a high-headed tree. I think in buying trees you should take in question both the height and caliper measure. For my own part, if I were buying trees and putting my own money into them, I would go to the nursery and see the kind of stock and pick out the kind of stock I wanted.

MR. SMITH: If all our customers came to the nursery how much time would the nurseryman have to get out his stock?

MR. CROW: I have done that several times, and so far I have always found the nurserymen perfectly willing to give us what we wanted. I believe in many cases it would be worth a man's while to go to the nursery to pick out his stock.

MR. MORRIS: In buying stock we must consider not only the height, but the caliper measure. Now so far as I can see unless some agreement can be come to on the point, the only way for a man who wants low-headed trees is to

buy them one year old. Would it not be fair to say why the nurserymen don't like to sell one-year-old trees. Regarding the man who comes in and wants one-year-old trees, I would say that the nurseryman doesn't want to dig them with a spade if he can possibly avoid it. If he does, he injures the trees on either side of the one that he is digging, or checks their growth, and he spoils a lot, so that the trees that are left over are not in first-class condition for making growth the following year or following season; that is one of the great objections to digging one-year-old trees. If the nurseryman could clean out all his stock in one year it would be a different proposition.

Q.—Cannot you get a low-headed tree from what you call seconds. You haven't said a word about the root of the tree—all about the stem. The root I should think would have something to do with it.

Mr. Crow: You don't get a low-headed tree from a second, ordinarily, for the reason when a tree gets to a certain height in the nursery it is headed off. If it does not get there the first year it does the second year, and you are simply a year behind the programme. In regard to the root of the tree, there has of course to be borne in mind that the vital part of the tree is the part you put below ground when you plant it. The most vital part is the root. You must have some top, but without the root you haven't got a tree.

There is one point that has not been mentioned which probably might be. I know a number of buyers who have gone to nurseries to select their own stock, and who have asked the nurseryman to leave these side branches on instead of having them all cut off up to this point or higher. These branches can be made use of in forming the head of the tree. There is a point there which might be worth considering if the branches are left on down low, there is the foundation for a good low-headed tree, as good as any man would want. If you want a high-headed tree cut that off, and if you want a low-headed tree cut off the higher and leave the low ones. If a buyer of nursery stock would state his requirements in this matter, it might be possible for him to come to some agreement with the nurseryman and have these branches left on. A man might order his nursery stock a year ahead in which case the nurseryman could head it at a suitable point.

A question has been asked as to whether or not there is any real objection to cutting off the entire top of this tree and make it throw out a new branch system. I have seen cases where that has been done successfully. In general, I doubt if it is an advisable method to follow. I think you will lose quite a percentage of trees, and I think the trees which do branch out will not be likely to give you a well formed head. I would rather not do it.

Mr. Morris: You say some fruit growers have gone to the nursery and requested that some of the side branches be left on the side of the tree. One of the first things a nurseyman does in the spring of the year is to rub off the buds. The reason for that is it is a great deal cheaper to rub off the buds than to use a knife in cutting off the branches. I do not know of any nurseryman that would leave the branches on the stem of a tree unless he was caught by weather or climatic conditions or shortage of help, because his trees would be unsaleable. There is absolutely no demand for a tree with the branches on.

Mr. Crow: In the particular cases I have in mind the orders were placed sometime in advance and it would be possible there to allow the side branches to grow.

Mr. Robertson: It is a vigorous tree we want, and we certainly have failed to get vigorous trees during the last ten years; that is the result of methods

introduced by nurserymen in order to possibly lessen the cost of production. We used to plant trees, and we could count on ninety-nine out of one hundred not only living, but giving us a vigorous growth. Now if we only get two-thirds of them that live, and put on a growth of two or three inches the first year, we consider that a success. I consider that is due to winter storage, and partly by spraying and careless trimming, and their method of exposing the trees unnecessarily to the air. We don't get value when we buy trees.

Mr. Crow: I am quite certain if you would buy a low-headed tree you would not have any of this difficulty.

Mr. Fisher: I am very much in favor of low-headed trees, and the reason is because I think they are more profitable. They are easier to trim, easier to spray, and easier to pick, and they are more sightly. The picker will save half an hour in a day's work handling a sixteen foot ladder in place of an eighteen foot ladder.

NURSERY LEGISLATION.

Dr. C. Gordon Hewitt, Dominion Entomologist, Ottawa.

The immediate reason I am here is that owing to recent events in Nova Scotia, namely, the discovery of the San José scale there, we have had rather an upheaval in that Province which has been rather satisfactorily settled. You must pardon me if I refer to what happened in Nova Scotia in reference to the San José scale. Up to the 15th April last, we in Ottawa, and no doubt you in Ontario, and certainly those in Nova Scotia, were dealing in ignorance of the fact that San José scale was in Nova Scotia. They all thought like British Columbia, that they were free from the scale, but one morning one of my men in Nova Scotia came across some nursery stock, and he having had three years' experience in nursery inspection in Illinois, was surprised to find San José scale on this nursery stock, and telegraphed to me as to its presence. I immediately instructed him to make inspection and to send specimens up to Ottawa, which he did. Though we tried to keep the discovery as quiet as possible, one cannot control a matter of this kind, and it got beyond our control. The people got frightened in suddenly finding that it was there. During the summer a thorough inspection was carried out by the Dominion and Provincial Departments of Agriculture of all the nursery stock which had been imported from Ontario, and from the United States to Nova Scotia, and I have here the results of that inspection. The numbers may seem small, but in view of the fact of what we know of the prolific character of the San José scale you can easily realize the disturbed state of mind of the Nova Scotia people in regard to this matter.

In 1910, they found that of the total number of properties carrying outside nursery stock, 247, there were 3 properties carrying infected stock, stock infected with San José scale, living or dead; in 1911, 71, and in 1912, 711—a total of Nova Scotia properties carrying stock infected with the scale either living or dead of 785. I realized that this might only be dead scales and that they had been killed in fumigation. At the same time I gave instructions that a very careful outlook be kept for the living scale, and such a lookout was kept. In 1910 stock, living scale was found on three properties, in 1911 on 71 properties, and in 1912 living scale was found on 127 properties, a total of 201, and the people were very much perturbed. Of course all these trees were destroyed. The Provincial Department

of Agriculture dealt with it as a Provincial matter and had them destroyed. As they had the power, the Department felt that they should carry it out, and the infected trees were destroyed. Now the estimated ratio of trees of 1912 planting which were infected was 30 per cent. The number of nurserymen shipping stock infected with living San José scale into Nova Scotia was 8. These infected trees, trees with the living scale, came from Ontario nurseries. I am not going to mention any names, because that is neither necessary nor advisable, and it would not be just to the nurserymen themselves; but all these infected trees came from Ontario nurseries. In no case was living scale found on trees coming from the United States. That is for two reasons—all trees in the United States imported to Nova Scotia go through the St. John's fumigating station where they are fumigated. It was found in practically every case that they came from nurseries which are inspected by officers of the various States. Probably every State of the Union which has nurseries, has very strict inspection laws, and they have to have the nursery stock inspected and are not allowed to ship the stock out of their nurseries without the inspector's certificate showing that the nursery has been inspected at different times and found practically free from scale, and after that has been done as an additional precaution it is fumigated at St. John's. Now, the infected stock came from nurseries in Ontario. You have in Ontario a regulation that nursery stock shall be fumigated. We have evidence here in this Nova Scotia enquiry that these regulations are not always carried out. In most cases the trees showed signs of fumigation, and a large proportion of the trees of 1912 planting showed most of the scale to be dead. It was common to find only one or two trees bearing living scale in a lot of a hundred, while often 50 to 60 per cent. bore dead scale. Only one lot apparently arrived in 1912 which had not been fumigated. Lots of one variety from one nursery almost invariably bore living San José scale. Whenever scale was present on this variety, it was alive, and on the more heavily infested lots there was no dead scale beyond the ordinary winter kill. In one lot of a hundred of these trees, the inspectors destroyed 25, the highest percentage found. They were not carrying out properly the regulations as to fumigation. As I have said, that naturally created a very highly-inflamed public opinion in the minds of the fruit growers down in Nova Scotia. Not only have they a fruit growers' association down there, but in practically the whole of the Annapolis and Cornwallis Valleys, they have co-operative societies in different towns, and the different societies are united in one company, known as The United Fruit Growers' Company. They passed a resolution calling upon the Provincial Government to absolutely prohibit the importation of Ontario stock. I felt in view of what their experience had been, they had some justification for complaint, and that it was an inter-provincial matter, and a very serious matter, and I felt that such measure was too stringent altogether for the circumstances which had to be faced. Nevertheless, the Provincial Government was in that quandary, and the Premier called a special meeting at Kemptville last month to reconsider this thing, and they asked me to come down there to see what could be done and to try and reason with the people. These fruit growers brought in a unanimous resolution asking that total prohibition of the importation of nursery stock from any infected province be granted—that is from Ontario. They did not specify Ontario, because they simply excluded Ontario. Not only that, but every co-operative society sent in delegates instructed to vote for that resolution, that was the condition of that meeting, and you may imagine it was a very interesting one. I pointed out the success which the Dominion Government had had in dealing with the scale in Canada, and I pointed out to them that such

a resolution was not justifiable unless it was felt that they could not deal with the situation in any other way. We had some such motion in 1898, when the Dominion Government was called on to prohibit the importation of nursery stock from any infected country, and the request was so strong and so urgent that the Government passed the San José Scale Act in 1898, prohibiting the importation of nursery stocks of trees of any kind, which shut off the United States stock. In 1899 they regained their senses, and saw what a quandary they had put themselves in, and asked that to be repealed with the resolution in 1899. I was asked if that embargo was removed, and stock allowed to come in subject to fumigation will you guarantee that every scale will be killed by fumigation, and I said no man will be such a fool to give such an assurance. I will give you my experience that during the eleven years the Dominion Fumigation Stations have been running no scale has been found to come from this stock. In no locality has living scale been introduced by stock fumigated there. In every case where scale has been found in a new locality it has always been introduced from an infected locality in Ontario. I pointed out to the people of Nova Scotia, surely you would be willing to give Ontario stock the same treatment. Well, to make a long story short, they finally withdrew this resolution asking for the prohibition, and calling upon the Provincial Government immediately to take such means as would prevent the further introduction of the San José scale. On their initiative the Provincial Government did pass an Act last year, requiring two changes: first, they required as to every shipment of nursery stock coming into Nova Scotia that a certificate shall accompany it stating that the nursery from which that stock had been shipped had been inspected from June 15th, to September 15th previously, and had been found free from scale. They limited the period of inspection to three months, and when they informed me as to the nature of their resolution I immediately telegraphed them, but it was too late to change it. I think that three months is a rather short time to carry on the inspection of nurseries. The real point was this, by showing they had assured themselves that they are starting with stock free from scale, they assured themselves that the Ontario Regulations are being carried out, and that they should make the same regulations that British Columbia does in regard to fumigation, and they are going to fumigate themselves all stock coming in from Ontario.

You will see as far as the Dominion Government is concerned, they have done everything in their power to help on matters in connection with both the provinces and to make matters run smoothly. They have succeeded in preventing the prohibition of the importation of Ontario nursery stock into Nova Scotia, and I think and hope this general discovery, this general outcry will produce better conditions here in the nurseries which will ultimately mean the commendation of the nurseryman's stock and be a benefit to the nurserymen themselves. Incidentally, this question has also resulted in the appointment in Ontario of a Provincial Entomologist, which to my mind is also a very satisfactory result. I want to refer briefly to the new regulations of the United States Department of Agriculture. I don't know whether any of our nurseries in Canada ship into the United States. If they do they will will be interested in learning that it will be necessary for them to bear these regulations in mind. The United States Department of Agriculture require a nursery inspection certificate similar to that required by many States. That is, if an Ontario nurseryman is going to ship into New York State, he will need to have his nursery properly inspected by the Provincial Department of Agriculture, and the necessary certificate issued under the signature of a duly qualified officer, and then also the United States importer

has to comply with very stringent regulations. Regarding the importation of stock as you know, all nursery stock coming from Europe or Japan or Ontario is inspected either at the destination in the case of Ontario stock, or at the port of entry in the case of European stock that is being imported. The Dominion regulations require that the importer shall send within five days of depositing his order, a notice to the Department, the number of plants he has ordered, the kinds, etc. In many cases that is carried out quite smoothly without any trouble from our end. I am sorry to say in a large number of cases and from some of the largest nurseries in Ontario we have to continually call the nurseryman's attention to the necessity of complying with these regulations. This year we took the following precaution, that wherever we had not received notice of the shipment of nursery stock that arrives from any one who knows the regulations (having had a copy of the Act sent him) we instructed the Customs Officers to refuse its entry. We think that is the best way of enforcing these regulations. Every one must agree that the requirement is a slight one which requires that notice shall be sent, and that it is not half so onerous as the requirement of the new Act in the United States. The United States Department of Agriculture requires that every man who imports nursery stock into the United states shall send them a notice giving the total amount of the shipment, what they are going to import, and when that is received the Department issues a permit allowing the goods to enter the States, and no nurseryman unless he has a permit from the Agricultural Department to do so, can obtain entry of his stock into the United States. That permit is issued in triplicate, one copy kept in Washington, one copy sent to the shipper, and a copy sent to the Customs official, and the Customs official will not allow importations of nursery stock to come in unless he has obtained a permit. You can see the stringent character of these regulations, and compare them with our requirements. Our requirements are not half so stringent. All the importer has to do when sending off his order is to make a copy and send the copy to Ottawa, and we keep that on file. It is allowed to go to its destination, and there we inspect it at its destination. It seems to me there is no excuse for failure of importers to comply with our regulations, in view of the fact that they are of so simple a character.

Q.—What does the Department at Ottawa do when they receive a copy of the order

Dr. Hewitt: They are all filed in our office, and when your stock arrives and you notify us in accordance with the regulations that they have arrived, we know exactly what you are getting, and in that way we can trace them to each customer's hands. If we did not have that notice we would not know whether the stock had come in or whether the stock has been inspected. The United States do not allow a man to import until he has obtained from the Department of Agriculure permission to do so. I might tell you we found on the Japanese stock eggs of the Gypsy Moth; they were simply swarming. You see the necessity and importance of our having this information in regard to what stock is coming in; otherwise we are not able to keep tab on it, and should stock come in infested we have knowledge of it. Now the custom officials notify us as an additional check, and also give us an opportunity to say whether that stock should be allowed in. Last year we had to prohibit the delivery of several shipments because the regulations had not been complied with.

Mr. Morris: I would like to ask without any disrespect to our Provincial Department at all, because I believe they have been thoroughly conscientious and

honest in their work—and on the other hand I believe if there has been any irregularity in this respect on the part of the nurserymen it has not been intentional but has been a miscarriage, just the same as sometimes takes place in our Courts of Justice—would the Dominion Government consent to use their influence to get Nova Scotia to accept the Dominion fumigation of stock, the same as it accepts the Dominion fumigation of stock from the United States, and elsewhere?

DR. HEWITT: That question has not been up for our consideration.

MR. MORRIS: Would the Department consent to consider that question if placed before it?

DR. HEWITT: I think it would. The Department's policy as to this question is rather the other way—the Department's policy in regard to this question of regulating importations and fumigations is rather the other way; that is, relegating the powers to the Provinces rather than assuming it. In the case of British Columbia, up to the last Parliament the fumigation was carried on both by the Dominion Government and by the Provincial Government, that is outside stock, not Canadian stock—stock from the United States. They fumigated outside stock and we fumigated it. There was constant fumigation and constant friction, and to put an end to it we made a new agreement with the Provincial Department of British Columbia whereby our regulations are carried out by them. They have the same power we have, and they carry out the regulations. I mention this to show that rather than the Dominion Parliament assuming these powers our policy is to relegate them to the Provincial Department.

DR. HEWITT: In some States the nurserymen have to have their stock fumigated twice. Some States have the same regulation that you have in Ontario requiring the fumigation of stock. Some of them, but not all of them. In any case they start with a certificate that the stock is free from scale—accompanied with that certificate.

MR. MORRIS: The Ontario nurserymen would like to avoid the second fumigation of their stock if it could be possibly arranged, and the way to do that it seems to me is to have the stock fumigated under the supervision of the Dominion Government in this Province previous to its leaving here, thus avoiding the breaking of packages and also the bundles in their examination, and having the great delay that is experienced by the Ontario nurserymen in British Columbia. The nurserymen to-day have withdrawn almost entirely, if not quite, from doing business in British Columbia on account of their drastic regulations.

DR. HEWITT: Your suggestion is that the fumigation should take place at the point of shipment, and that the fumigation should be carried out by the Dominion Government.

MR. MORRIS: And should be a final fumigation.

DR. HEWITT: I do not know whether the Dominion could exercise such powers over the Provincial department as that.

Q.—Is there any guarantee that this same stock with scale that has been going over Nova Scotia has not been sent out through Ontario.

MR. HODGETTS: We have had cases where Ontario stock coming from the nurseries has been found infested with living scale, and we have either destroyed the stock or treated the scale, but we have never had as bad instances as those reported from Nova Scotia the last three years. We have no bad cases where the scale has spread into new districts from infested stock—practically all has spread from the orchards that were infested when the scale came in first from the United

States. We hope now, under Mr. Caesar's charge, we will be able to get a proper staff organized and look after it better than we have in the past. We think the nurserymen shipping into Nova Scotia should be granted a certificate. The same regulations will apply to stock going into Ontario as applies to stock going into Nova Scotia, we think certainly the interests of both the Ontario Grower and Nova Scotia grower should be protected.

Mr. Morris: What were the total number of trees in Nova Scotia found infested with living scale?

Dr. Hewitt: In 1910 three trees; 1911, 71; 1912, 127; total 201. The total number of properties carrying outside nursery stock 1,744. Total number of properties carrying stock infected with San José Scale living or dead for the three years 1910, 1911 and 1912 was 785, the total number of properties carrying living San José Scale for the three years was 201.

Mr. Morris: The number of trees destroyed I think was approximately 600 trees.

Dr. Hewitt: Yes, 693 trees destroyed.

Mr. Morris: When you consider there were 157,000 trees examined and out of those between 600 and 700 had live scale, and probably many of those with only a few—it was a very small percentage.

Dr. Hewitt: I agree with you.

Mr. Morris: And Dr. Matheson said that fumigation would probably kill about from 96 to 98 per cent. of the scale under the most favorable kind of fumigation, as is general and customery. So I think Ontario nurserymen are not quite as black as would appear, because out of 157,000 trees only 600 or 700 trees were found during a period of three years to be infested. That is not very bad, but of course it is bad enough.

Dr. Hewitt: It is bad enough for the Nova Scotia people, and of course some of the Ontario nurserymen did not improve matters by writing down to the people there who had infested stock and telling them that they ought to be thankful that they had got the scale stock as they would spray better, have better trees and better fruit. Some others wrote down and said they had absolutely no scale in their nurseries. The fruit growers of Cornwallis Valley and Annapolis have letters of that kind, and you can imagine how it kindled the flames. From my experience in fumigation, a second fumigation if the trees are in a dormant state and dry will do no harm. If the trees are wet, or if the trees are putting out their leaves, it is likely to do damage. If the trees are shipped in the dormant season and fumigation takes place when the trees are dormant and dry, I do not think a second fumigation will be injurious. What we do in the case of Dominion regulations is, that if trees arrive late in the season, in the leafy season, if the buds are beginning to burst and leaves are beginning to form, and if there is any danger of fumigation, we inform the importer we will fumigate them at his risk, and if they won't take the risk, the trees are not allowed to go through.

Q.—The subject under discussion in Nursery Legislation. May I ask, if you are going to confine the remarks to Nova Scotia, whether Nova Scotia fellows have legislation that the trees should be true to name. We can control legislation as to scale and not as to the name. Trees formerly were true to name. In a few cases we would get a tree or two that was something else. In every case it was a good graft. To-day we take out from 30 to 40 trees every year—as trees come to bear—all trees that are not true to name. They are absolutely worthless varieties—clingstones.

I have, perhaps, thirty or forty of them to take out this fall. They are white flesh clingstones. These have not come from any particular nursery. They are from different nurseries, and I think it is certainly time for this Association to take some steps to get the nurserymen to act with the fruit-growers. If they have to have more money for their trees to supply us with stock they can guarantee I think the growers would be in favour of that. There should be some class of stock that they can guarantee. I think things are getting worse. And I think it is a subject that is worthy of discussion.

THE PRESIDENT: I quite realise in listening to the discussion that it seems to be very important that the nurserymen should be controlled in some way in regard to the products that they are sending out through the country. Mr. Smith raised an important point when he asked if the nurseries of Ontario were sending products around the country—trees infected by the scale. If they are, we do not know where it is going to end and how far it is going to go. The question is brought up as to whether the trees are true to name or not. I believe there is a wide feeling, and a serious feeling, among the fruit-growers in regard to this matter, and many trees are received which are not true to name. A man told me the other day that he thought he had only three or four varieties, and he found that the most of them were not true to name. I find in my own peach orchard—an orchard I have taken a great deal of pride in and care in planting—that two rows from end to end of that orchard are absolute trash, and in fact not good for anything, a disgrace to the orchard. In my county of Lambton the last few years several hundred thousand of trees have been planted out, and I rather think it would be a wise thing to submit this to a committee and let them take it before the resolution committee and let them discuss it. I would suggest that those present interested in the matter appoint a committee and let it go before the resolution committee and discuss it in the afternoon. While that committee is being formed I would ask if Mr. Caesar has anything to add in view of the discussion that has taken place.

MR. CAESAR: I think the less I say at the present the better. I am trying to absorb the ideas or to grasp the situation as well as I can, and would like to think over it for a considerable time. I have been looking into the nurseries, and I have been consulting the different inspectors in regard to the different nurseries and their condition, and am feeling my way gradually to better nurseries—to secure clean nurseries. But it is a great big problem and a very difficult one, and much more difficult than I used to think it was once. It seems to me that a person should be very very careful not to make suggestions off-hand, and for that reason I do not care at present to make any proposals before this meeting or discussing the question very fully until I have satisfied myself as to the wisest methods involved, and after consulting with a number of others in regard to this matter. I enjoyed very much hearing the nurserymen's views in regard to these matters. I know that question of double fumigation is a great big problem. We have the statements of men like Professor Hendrick, of Geneva, that if he had his choice he would never have stock fumigated at all. Then, again, we have the statements of other men just as great horticulturists, perhaps, as Professor Hendrick, that they think fumigation has no injurious effects on nursery stock, provided it is done with ordinary precaution, and that the trees are at a proper stage for it. To get to that stage it is difficult. If stock is shipped to Nova Scotia, one can easily sympathise or can easily feel how hard the Nova Scotia Legislation will hit nurserymen, provided they do not make any alterations—alterations which we would hope would be equivalent to the present measures. I do not feel like making any suggestions at the present moment in regard to these things.

DR. HEWITT: Before the meeting closes I should like to say, in order that there may not be any misapprehension that I am quite in favor of the system of inspection and fumigation going together and being carried out in the nursery. That is, of a system of inspection of the nursery, and a certificate issued that the nursery is free from scale; also that every shipment of stock going out from that nursery should be fumigated. I think that is the system we should try and get. Every nurseryman should carry out that, and have the foreman see that the men who do that work do it properly, seeing that all stock going out is properly fumigated. I know the nurserymen themselves are anxious that their stock should go out clean, but they usually leave the fumigation to the foreman and men. If the men are anxious to carry out these regulations and anxious to ship out stock free from living scale that would be the ideal system. Then we may have this inspection of the nurseries and the fumigation at the nurseries, and do away with this discrimination and this second fumigation by other provinces—by both Nova Scotia and New Brunswick. That system would be an ideal system, and I for one, more than anyone else, would rejoice to see such a system universally adopted. But as far as we are at present concerned, you will understand that it is impossible, in view of the fact that the present requirements are not now carried out sufficiently, and the British Columbia and the Nova Scotia people have found out that living scale was being imported. If that had not happened, in neither case would the fumigation of Ontario stock or of New Brunswick stock or any other stock have been carried out, and we must hope that in the future—and near future—we can so arrange things and so have our provincial systems and inspections so guaranteed that one Provincial Government can accept the certificate of the other Provincial Government. When that arrives then I am sure that the whole thing will be settled, but not till then. You must understand the present circumstances do not permit any Provincial Government to do otherwise than they have done. My sympathies are very much with the nurserymen, because I know the difficulties they have to contend with.

Q.—Supposing a one-year-old tree was affected, and other healthy trees planted say thirty feet apart, which is likely to happen, would the scale kill that tree or the scale spread from that tree to other trees first? I understand the scale is almost fatal within a year or so?

DR. HEWITT: I think if the tree were infested with the living scale it would be more likely to kill that tree.

Q.—In the cases you found in Nova Scotia, were there evidences of the scales having spread from one tree to another at all?

A.—No.

Q.—Not even on three-year-old trees?

A.—No.

Q.—It was confined in each case to the original infection?

A.—Yes.

Q.—The point I want to know is, in a young orchard is there a likelihood of the scale spreading?

A.—I think there is; yes.

Q.—I can easily understand in an old orchard, where the trees would be nearly meeting, the danger would be very great, but where the trees are young and well apart and the ground is under a hoe crop, is there any likelihood of it spreading?

A.—I think there is. There are many things that will carry it—flies, bees, lady bugs and the feet of birds.

APPLES.

J. R. Anderson, M.P.P., Leamington.

My first word this afternoon would be to congratulate the Ontario Fruit Growers' Association in the magnificent success of the show, which I have had the pleasure of visiting, over in Exhibition Park this morning. I also desire to congratulate the Ontario Fruit Growers' Association on the activity they have displayed in assisting, and being a very important factor, indeed, in the building up of the fruit industry in the Province of Ontario in recent years. I am to speak regarding the best six varieties of apples. The Fruit Growers' Association have committed themselves to the problem of the better growing of apples, and the great activity they have displayed in that regard has brought us face to face with another problem, and that is the problem of over-production. It seems to me that apples to be grown at a profit in the future must be apples that will command the attention and the demand of the buyers, both in our own West and in the markets of Great Britain, because that is where we must seek an outlet. At the outset I may say I do not expect that all the growers in this room will at all agree with the varieties that I have selected. The first variety I would select, and the first maturing variety, would be the Wealthy. Now, to my mind the Wealthy is one of our very best early apples, in fact the best. It is the most productive, and it is an apple that requires to be grown under proper conditions, as every other apple requires to be grown. They must be thoroughly pruned and thinned on the trees. You cannot grow Wealthies successfully unless the trees are not only thoroughly pruned but thoroughly thinned as well. It is just as important as thinning a field of turnips. They are popular both in European markets and in our western markets. There is a decided demand for the Wealthy variety, and so I begin with the Wealthy.

The next variety I would name is the Snow or McIntosh. You can choose between the two. They mature after the Wealthy apples would be harvested and marketed. They are also popular in both markets and a safe proposition, and you can make your choice between the two. They will be a profitable apple to grow in the future. The next variety would be the old standard variety of King. I hope the growers of Ontario will never cease planting Kings. They are certainly popular in any market. It does not matter where you go you can always sell Kings, and always will be able to sell them. Some objection may be taken that they will not be a profitable apple to grow, but I do not concur in that opinion. You may not get so many barrels but you will have the satisfaction of knowing that what you have got is worth something, which cannot be said of some other varieties.

The next apple in order of merit would be the Golden Russet, another apple which I suppose is not altogether popular with a great many growers. You may think you may not get as many barrels from the Golden Russet trees as the Baldwins or Greenings, yet the Golden Russet is one of the most popular apples in the market of Great Britain. If you cast your eyes over the market reports coming from London, Glasgow or Liverpool to-day, when the markets are very much depressed, you will find Golden Russets are returning a very fair profit on the outlay.

I was almost inclined to eliminate the Baldwin, but on second thought I did not see how I could very well dispense with it. For the fifth I would put down

the Baldwin. You can always depend on it. It is a prolific bearer and a standard marketing apple in all markets. My last variety, and I do not think it is the least by any means, would be our old standard, the Northern Spy—the Canadian Northern Spy. The demand is greater, I may say, for the Northern Spy than any other apple, particularly in our own western markets. The Northern Spy is the best apple we grow, I think, and the worst apple. Now, there is a statement and one part directly contradicts the other. Grown under proper conditions with the right kind of Northern Spy there is nothing finer in the world, and nothing more popular in any market anywhere. On the other hand you take a poor Northern Spy, and unfortunately a great many of our growers stick closely to that kind, it is the poorest apple we grow. The Northern Spy without any colour is the poorest excuse for a Canadian apple that is put into barrels and put on the market anywhere. If I might borrow a phrase from my friend Mr. Carey, the Dominion Fruit Inspector, I would say these green Spies lack character. It is a very good phrase, I think, to express the idea, and the sooner our growers get it out of their heads to keep putting them up in barrels or boxes the better. I do not suppose they put any in boxes. The sooner they get it out of their heads to pack these poor colored green Northern Spies the better it will be for themselves and the better for the Canadian market. If the growers of the Province of Ontario could only appreciate what our Canadian apples have got to contend against, particularly in the western markets, they would be ashamed of the apples that I have seen in barrels in the markets of our Western Provinces, when they are compared with apples received from British Columbia, Oregon and Washington. Every apple is wrapped, and our stuff shows up as badly as it possibly can in many cases, and it is no wonder that that market is slipping away from us. If we do not waken up some fine morning that market will be gone from us permanently. They do not want our green Spies in that market, but they want our good ones, and they want all we can grow. If the Minister of Agriculture is present this afternoon he can do no better work for the apple industry of the Province of Ontario than by carrying on experimental orchards and demonstrating how to grow perfect specimens under perfect conditions, and send that information to the fruit growers of Ontario. There is a certain kind of Spy that I think must be grown under too intense cultivation which grows very coarse and large, and has not a good color. There must be conditions under which we can grow Spies something like we saw over in the Exhibition Park this morning, highly colored specimens. That is what the market requires.

I have given you my idea of six varieties. I know all of them will not meet with your views as to what is best. Perhaps it is best that it should not or there might be an over-production in those varieties, but if the apple producers of the Province of Ontario will stick fairly closely to those six varieties and produce them to perfection they will not make a very great mistake.

W. T. Macoun: The only change I would make to that list is the Rhode Island Greening to take the place of the Golden Russet. The reason I make that suggestion is this: The Province of Nova Scotia grows, in my judgment, the finest Ribston Pippin, Golden Russet and Roxborough Russet in Canada, and they have an immense number of trees of those varieties. It seems to me they will in the near future pretty nearly supply the market for that type of apple. Now, I do not know any part of Canada where a Rhode Island Greening is grown so well as in Ontario, and I believe that that would be a more popular variety than the Golden Russet.

Mr. R. H. McCurdy: I feel like saying I think some of the varieties that we call colored varieties, not the very high colored, and long keeping varieties, stand up well for the export market, and can be raised for about half the price or half the cost of the others, and would pay, although I do not say, don't put in better varieties. I will name one, the Gale.

A Mebmer: I think that is a very important point about the Golden Russet and the Greening. I think it would be a very nice thing as there are a large number of growers here if they would say which of those apples they would prefer put in this list.

A Member: The Ontario Russet is worth about two of the Nova Scotia Russet. One barrel of Golden Russets from one end of the season to another will usually bring on an average about as much as two barrels of Greenings. I do not see why the Golden Russet should not be left.

Mr. Peart: The locality has a good deal to do with it. In the Georgian Bay district I am told the Ben Davis answers the purpose. Down east in the Trenton district a great many fruit growers tell me they make money out of the Ben Davis, and also in the West and Northwestern part of the Province. In the district where I live I do not know a single man who is planting the Golden Russet. They think there are some other varieties they can plant to better advantage. Speaking for myself if I plant apples next spring I will plant a lot of the varieties mentioned by Mr. Anderson excepting the Golden Russet, and I would substitute for it the Ribston Pippin.

Mr. W. Fisher: I see some nurserymen here to-day and they could tell us how much demand there is for the Golden Russet.

Mr. Hammond: I have just spent about seven weeks selling apples in New Ontario and Quebec Province, and the apple I had the greatest trouble getting rid of was the Greening. Now, if the Greening had another skin on it, one of a different color, it would be one of the most ready selling, but as it is it is one of the most difficult to sell. I know that from practical experience. If I were to substitute one for the Russet or Greening I would name the Stark.

Mr. G. C. Caston: Greenings grown in the Georgian Bay district are winter apples, and they keep till spring. Regarding the Russet it is regarded very unfavourably in our own country. It will not stand the least bit of warmth. With the least bit of heat the Russet will shrivel, and at the same time it loses its flavor. If it is kept in cold storage it is a good apple, but it is a poor bearer. I would not invest in Russet trees if they gave them to me for nothing, and I have been growing them for thirty years. I think the substitution of the Greening for the Russet is a very good one. The Greening is one of our very best winter cookers. If there is anything better in the way of a winter cooker I would like to know what it is. The Ben Davis is a very handsome apple but a very short lived tree. The Northern Spy is king of them all.

Mr. Wilson: What is the Jonathan apple like? I see in Chicago it is very popular and is recommended very highly. If it is good for them it ought to be good for us.

Mr. Dempsey: In Ontario the Jonathan is a much smaller apple than the Snow. It is exceedingly handsome and is ready for use in February and March. It is a very nice apple, and very productive. Possibly if it were thinned and the tree cut back you might be able to grow them all right. As far as the King is concerned I am willing to admit it is one of the best apples from the buyer's standpoint, but

from the grower's standpoint it is not worth anything. It takes about 75 trees to get one barrel. As far as the Golden Russet is concerned I have found it a very sectional apple, only succeeding in a few places, and where it does succeed it is certainly a profitable apple. The King is a full brother to the Ben Davis, but it is a black brother. I wouldn't want anybody to plant it.

Mr. Brown: I put out a year or so ago between two and three thousand trees, and four of the varieties mentioned here I chose amongst my leaders, the Wealthy, the MacIntosh, the Baldwin and the Spy. I put in enough Kings to say I had some Kings there, because the King is an apple that carries a name with it. If I want to sell the orchard at any time it is nice to be able to say I have got some Kings. I have harvested Kings for three years now, and I can always pick out a Baldwin tree that has got more money on it than fifteen King trees in my orchard. I did not plant any Greenings at all. The Russet has not been a profitable apple with me at all. The two varieties that I would choose to fill out the six would be the Blenheim and the Duchess. The Blenheim packs well and is a firmer fruit. It is a strong growing tree, a large apple, and a magnificent dessert apple. It comes at a nice time of the year to pick apples. It has always panned out well with us, what we have packed, and they are over before the other work comes on. I figure that my Duchess will pay for my orchard before I pick a Baldwin or a Spy. It is profitable apples we are discussing and that is my opinion.

Mr. Young: The list that we have confined ourselves to is the Wealthy, the MacIntosh, the Duchess and the Greening. I would like to ask as to the hardiness of the Blenheim?

Mr. Brown: I do not think the Blenheim is a hardy apple. I do not think it is a good proposition outside of Southern Ontario. I may say this much for the Duchess. In Norfolk County they are marketed somewhat before they are in the rest of the Province. I did not know about this last year, but the year before I know our Duchess apples were gone sometime before Toronto Exhibition. When I came to the Exhibition here the only apple that amounted to anything was the Duchess. They were from other parts of the county. The Duchess is an earlier apple with us and consequently strikes the market before the rest of the Province.

The Chairman: This discussion goes to show that while it is desirable to reduce the number of varieties as much as possible there are certain limits connected with the industry which prevent us from laying down any arbitrary rules. I was rather surprised in Mr. Anderson's address that he did not break over the bounds and add two or three varieties to those that he mentioned, notwithstanding that he had been confined to six. It goes to show that we cannot possibly confine ourselves in this Province of Ontario, much less the Dominion of Canada, to only six varieties of apples, but that we must consider the surroundings and the conditions under which we are working, and select for ourselves under the guidance of experienced men such as we have here to-day.

Mr. Onslow: If there is time I think it would be advisable to give the names of three of the best early bearing varieties. In the Niagara district and the southern part of Ontario there is a considerable demand for early varieties to ship in boxes and baskets, and I think it would be well to mention three of the early bearing varieties for the early western market.

Mr. Bunting: Mr. Kimmins has had a large experience both as a grower of nursery stock and also as a shipper of fruit trees, and I would refer that question to him.

Mr. Kimmins: I do not know, Mr. Chairman, that I could name three. Mr. Brown referred to the Duchess. I think if I were advising anybody to plant early apples I would say the Duchess. There is a demand which is growing every year, particularly in the West, and I think anybody who wanted an early variety, and wanted to capture that market ought to grow that variety. We have had no experience in shipping the Astrachan or the Yellow Transparent to the West. Perhaps some of the St. Catharines people have had experience in that respect, but you cannot very well pack the Astrachan in a barrel, and I do not know how they would go boxed. There are not enough of them growing to make any kind of a shipment, but now people are planting the Duchess in sufficient numbers to enable a shipper to gather a sufficient quantity to make up a carload lot.

Mr. Hamilton: We get most profit out of the Duchess, I think, and the St. Lawrence.

Mr. Hopkins: I am a little surprised that the Alexander has not been mentioned. It is good for selling and for bearing. I would like to say something in reference to the MacIntosh. It has been planted very largely and I have been growing it for some years, and I want to say that it is the worst apple to leave the tree that I know of. I have gathered up several bushels under a MacIntosh tree after a wind storm.

PEACHES.

William Armstrong, Queenston.

Gentlemen,—I am requested to name six varieties of peaches which I would consider best for what? For a new up-to-date commercial peach orchard. I want you to bear in mind that word "commercial" in all I have to say. After forty years' experience in growing peaches, and especially considering the experience that I have had this last two or three years, I have come to the conclusion that if any young man wishes to plant out a peach orchard—say a young man who has been given $10,000 or $20,000 and who is going to work to put out a peach orchard—I want to advise him so that he will not lose money, but will at the close of twenty years have a competency to retire on if he follows it out. I am not going to give him to-day, though, the full details. I may later on. In view of this experience I will name but three varieties, and these three varieties you can bank on. They are varieties you will have no trouble with. I have selected them for their hardiness, and as to coming in at seasons where they will not overlap too much. If a man has 1,500 trees or 2,000 trees of these varieties, and half a dozen or eight pickers, they can follow this thing up through the season. I want you to remember in putting out this orchard that the peach season is only a short season. It is utterly useless to put peaches on the market when other varieties of fruit occupy that market. It is an infringement on the apple grower for the peach grower to send his peaches right through to November. That is my opinion. The three varieties I shall name I think are fairly familiar to all peach growers. I will begin with the Yellow St. John. There is a glorious peach, handsome, good color, good size, and coming in just when the people want it. We pick them on the Niagara River about the 20th August. Now, that is early enough. It is a grand peach and you can bank on it. It is a money maker, a good bearer. The only feature that is against it, and you will always find some little weakness, is that it is liable to

cluster too much, but that only occurs when it is about eight years old. From that on it is apt to throw out these small spurs about an inch and a half long, and those spurs will throw out four or five buds and you will have four or five peaches. With simply a little extra trouble you can rub them off. Rub the peach off when it is young. This year I have 1,500 Yellow St. John, and I made a nice lot of money out of them.

The next one you are not so familiar with, and in fact for years I did not notice the peculiarities of this grand peach. In fact its characteristics were forced on me, and I had to admit that this middle peach was the best of them all as a money maker—the New Prolific. It is a dandy. The New Prolific produces its bud in double bud. There are two double buds stand out and in the centre is the leaf bud. That is the way to recognize it—it has the ability of throwing out the double bud. A piece 14 inches long may have 40 or 50 or 60 buds on. It is a simple matter in the winter to cut it back to three or four or five buds. I do not think it is necessary for me to speak any further in regard to the peculiarities of the New Prolific variety. You will get through with your Yellow St. John and you will have a few days to spare before it comes in, and just there there is a variety that should come in, but I will leave that for you fellows to fight over. It should be a Crawford. I hesitate to name the variety in the Crawford family that should come in between the Yellow St. John and the New Prolific. However, in my opinion it would be the Fitzgerald. The Fitzgerald has the ability you might say to over-bear itself, and as a result it requires unusual trimming and thinning. Besides that I find the Fitzgerald does not color up quite as fancy as I would like. It is fairly good, and some people get better resutls than I have noticed. Then there is another variety coming in just about the same time, the Garfield, which would come right in there for a few days. Some call it the Brigden. Then there is one more that possibly might be well to have, and that is the Foster. The trouble with the Foster is, it is weak in the bud and it frequently gets winter killed.

Q.—When will the New Prolific come in?

Mr. Armstrong: About the 25th or 26th or 27th August, with us. We are shipping New Prolific on the 1st September, and then on the 5th September we run right into our Elberta. That is the last variety that I will mention. Everybody is familiar with the Elberta. I have been talking to one or two of the principal growers in regard to suggesting a later variety, and it has been suggested one variety a little later might be all right, but I am banking on these three great varieties. You can make no mistake about them.

Q.—What do you say about the Smock?

Mr. Armstrong: It is altogether too late. I think the young man who starts must learn from those who have had experience, and those are two or three varieties that he is absolutely certain of, and he can get them on the market and get his money out of them.

The President: The four varieties you would recommend are the Yellow St. John, the Fitzgerald, the New Prolific and the Elberta?

Mr. Armstrong: Yes.

Q.—What about the Jewett?

Mr. Armstrong: That is an early peach and is fairly good, a semi-free. I would not plant it.

THE PRESIDENT: Down in the Leamington district they think a great deal of the Kalamazoo?

MR. ARMSTRONG: I am not familiar with it.

MR. ONSLOW: It is an exceedingly large peach, and if it is picked a little on the firm side it is very good. It is very tender in the skin, though.

MR. SHEPPARD: I have Niagaras, and my brother just across the fence has Niagaras. Now, he has made more money out of his Niagaras than anything I have got, and my Niagaras are not worth anything. If mine are the right thing then I wouldn't have them, but if the ones my brother has are the genuine article then there is nothing better in the district. I am inclined to think he has not got what he bought as Niagaras. They were got from a nursery.

A MEMBER: I have had very good success with Reeves' Favourite. With me it has been a very profitable peach.

Q.—What do you think of the Oceana?

MR. BUNTING: It is a good peach.

PEARS.

M. C. SMITH, BURLINGTON.

I know it will be a surprise to a good many of you to hear anything from me on this subject. I have been associated practically all my life with apples, but I must admit that if I have a second love in fruits it is pears. I am expected to advise you on the six most profitable kinds of planting. I must admit again I have not done a great deal of pear planting, but I have handled and grown a very considerable quantity of pears in the last eight or ten years. To give you an idea of the quantity of pears I grow, I may say that this year in our different orchards we had of our own growing over five thousand bushels of pears, and I had to buy others in order to supply the demand, and I feel that I know a little about the profitable varieties. If I were to plant myself an orchard at all, I would plant pears. Like Mr. Armstrong here, I feel like cutting down those six varieties to probably three. There are a good many varieties of pears, and one variety might suit one locality better than another. I am sure that the same varieties of pears will not suit all locations and all qualities or grades of soil.

The first pear I would pick out, and I am sure the majority of the people here will agree with me, would be the Bartlett. I would put it first and foremost in value. In quality it cannot be excelled, and in appearance and in yield it is good. It is a profitable pear to grow for our local markets, and a profitable pear to grow for export. It is welcomed and appreciated in our markets. It is a heavy cropper and an annual cropper. The trees are long-lived. Now, I am going to get into trouble on the next variety of pear, the same as Mr. Anderson did on his apples, but sticking strictly to the subject, for profit I have got to recommend the Kieffer. Now, I can see you men smile, but I have got to tell you it has got a lot more merit than some others, and the longer we grow it and the more it is used the more it is appreciated. It is an early bearer and a heavy bearer, and probably the easiest of all pears to take care of. It is uniform, and it has many other desirable qualities. It is not very popular on our local markets except for the canning factories. In

Toronto or Montreal or in other cities they are not appreciated. There is a growing demand every year in England for the Kieffer pear. One of the largest receivers of fruits in Great Britain advises me every time I see him to plant more and grow more Kieffers. He says the more the people buy them the better they like them, and the demand is increasing all the time. The canning factories prefer the Kieffer to any other variety, probably next to the Bartlett, but where they pay three cents a pound for the Bartlett, and I may say that is what I sold mine for to the canning factories here in this country, the canning factories pay one and a half cents a pound on an average for the Kieffer pear. They cannot always get as many Bartletts as they want, and I know a great many pears that are labelled Bartletts that are really Kieffers. They do not always can the Kieffers now, as they did in the past, green, but they allow them to mature and ripen and colour yellow, as they will, and then when they are canned they are marked Bartletts, and sold for Bartletts, and any man who buys them will get just as good value as if he had got Bartletts.

Now, the third variety will be the Duchess. The Duchess is another pear that can be exported profitably. It is also appreciated in this market. It is a fairly regular bearer, and when it does bear it fills up the barrels and boxes very fast for they are very large, and usually an easy pear to take care of.

After the Duchess I am just a little at sea. From the results of my own experience in growing pears I have got to name the Anjou. I know it has its faults. It does not bear very early, and for some people it does not bear very regularly, but with us it has been one of the most profitable pears we raise. Our trees are matured and we get a crop every year. We get a full crop every other year, but a good many pears every year. It is a pear of very high quality and it can be exported, but it is appreciated and there is a considerable demand for it in our own country.

After the Anjou I am still more at sea. There are three or four varieties that I could mention. I would name the Bosc as the fifth, and for the last variety I have got to recommend Clapp's Favourite, although I know I will get into trouble with the people from the Niagara district. I know it spots pretty badly, and probably spots more in the Niagara district than anywhere else, although I will say for those people they can grow peaches. Clapp's Favourite in our section and throughout Western Ontario is a profitable pear. It is a very fine bearing pear and a good cropper. There are three or four other varieties that are very good. There is the Clairgeau, the Bonne, the Sheldon, and the Seckel. I would name for my varieties the Bartlett, the Kieffer, the Duchess, the Anjou, the Bosc and the Clapp's Favourite, for profit, for I believe that is what most people are growing fruit for.

Q.—Is there any reliable early pear that you know of?

MR. SMITH: Nothing earlier than Clapp's that I would recommend.

A MEMBER: The Giffard is pretty good in the Niagara district.

PLUMS.

W. DEWAR, FRUITLAND.

In choosing the varieties of plums you may have great difficulty in getting down to a few. In selecting the best six varieties I had not much difficulty in my own mind with regard to five, which I would recommend from a commercial

standpoint. In growing plums I think we have to consider the canning factory demand more than anything else. Our plums are not eaten out of hand so much as the California plums. The California plums take the precedence on account of their appearance and method of packing. From my point of view, too, we have to base our decision on the growing of a small plum from what you might call a medium sized plum and the larger or fancy plum. That has to be considered in choosing the varieties. You have also to consider from the standpoint of the fruit grower where the most profit arises. I think with plums we should try to get as big a crop as possible with a fair profit rather than try to get a plum of good quality like the German prune which will give us quality but will not pay.

I would start out I think with the Burbank. It is a heavy yielder and a magnificent shipper, and comes in early in the season, and is splendid for shipment to the west and for local shipment. It has to be carefully watched and pruned or else it will get out of hand, but I think the Burbank is worthy of first place. There is one objection to it, it is liable to run to small plums. I understand there is objection in that regard. Next to that I place the Bradshaw. This is a fairly good shipper and if packed firm will stand shipment to the West. It is liable to rot if allowed to go too far.

MR. ARMSTRONG: It is sometimes called the Niagara.

MR. DEWAR: I believe there is a slight difference. I am not very familiar with the exact difference.

The next I have following the Bradshaw is the Reine Claude. I am probably not taking them in the exact order of ripening. It is a good plum. Following that I put the Lombard. That is the cheapest plum for canning factories and shipping in large quantities, and it is a plum we have to take into consideration because many people who buy plums want the Lombard, and we have to plant it to a certain extent. Then after the Lombard I would put the Monarch as a late plum. It is a plum of excellent shipping qualities, and a heavy yielder. I think the Monarch should be included. Now, those are five that appear to me to be in the list as commercial plums, taking from the beginning of the season to the latter part of the season so that the picking would extend equally throughout. Now, as to the sixth I have some doubt. Taking it from the standpoint of local orders, or the standpoint of shipment to the West, if we looked upon the Western shipments we should include the Shropshire Damson. It is very likely to be overplanted I think. It is the highest priced plum I know of, and there is no telling when the demand will drop. If I were planting with the view of a Western market, I would plant some of them. When I mentioned the Lombard I had great difficulty in deciding amongst three varieties, the Lombard, the Gueii and the Orleans. The Gueii or Orleans are fancy plums if well grown, and you can get a better price for them than for the Lombards; but in a commercial sense they probably would not be placed along with the Lombards. Then the Monarch has two or three competitors. There is the Grand Duke and the Black Diamond, and there may be many others that one would plant, but they would be put in as fillers and I do not think they should displace any of the others from a commercial standpoint.

Q.—What about the Pellenburg, the Italian prune?

MR. DEWAR: I would place it with the German prune. I think it bears very well, but not very heavily.

Q.—What about the Imperial Gage?

MR. DEWAR: That was a plum I intended to mention. I think the yellow

plums should be included for local shipment. The Imperial Gage and the Washington are two I forgot to mention. Of course as I said, I think I would take my other five first, and use the Imperial Gage and the Washington as fillers amongst the others.

Q.—Do you know of any good early plum, earlier than the Burbank?

MR. DEWAR: Well, some people make good money out of the Willard, but I think that is too early for the market. The market is not ready for plums at that time.

Q.—What about the Red June?

MR. DEWAR: I would not include that in a commercial orchard. That is, in picking out five or six varieties.

THE PRESIDENT: I have been growing some myself and we always find the Imperial Gage gives us better returns and better satisfaction than any other plum we grow. We find a great many of our customers want that plum for household canning.

A MEMBER: I think if you would use the Reine Claude you wouldn't use the Imperial Gage.

GRAPES.

F. G. STEWART, HOMER.

I think I will copy Mr. Smith and not take the varieties as they grow, but take them as a commercial crop. The first is the Concord. One of the strong points in that is, that the bud in the spring comes out woolly. If you take a grape like the Rogers with a smooth bud, if it gets a least bit of frost in the spring it goes. You can have a Rogers variety with the smooth leaf and you will find the buds cannot stand the frost, whereas if you take the Concord it has a woolly coat and the frost will stand out on top of it. It grows on sand or clay and makes lots of wood. It is a good shipper. In fact, it is like the Bartlett pear. That is the very best first, I consider, and I have been growing grapes for about forty-three years. The next is the Worden. It has one little fault. It is a little inclined to be tender for long shipment, but it has good bearing qualities and you cannot beat it for a table grape or even a wine grape. The next is the Niagara. Those three grapes are like Mr. Armstrong's three varieties of peaches. Those are the three commercial grapes. If we want a grape for an early grape take Moore's Early. I would not advise anyone to plant Moore's Early on light ground as it does not make enough wood. It is not as hardy as the Concord and the Worden, but it is a woolly grape, a black grape, and a good grape. Then I suppose we must get some red grapes in, and for a good red grape I take the Vergennes, for that is a grape that will grow in sand or clay. It is close-jointed. With the Concord there are as a rule two bunches to a bud, but with the Vergennes there are four or five, and then it has a tendency of throwing another little stem from that bud that will have two, and you will have from the Vergennes often six or seven buds. So you see the necessity of cutting them short, down to about six buds. If your vines are ten feet and have six buds and four arms, that is twenty-four buds, they will always ripen. I have seen people grow them off the same length of wood and twice the number of buds and it would be late in the fall before they would colour up. The next grape I take is the Agawam.

That is a grape which I think is better for clay. If you have it on light soil it is apt to give you too much wood. I confine myself to those six. If someone else were here they might pick the Delaware or the Salem, but those are the six grapes I would recommend. I believe up around Winona they grow the Lindley, but that grape does not fertilize very well unless you clip the tips when they are getting the blossom. That takes time and it is not always done.

Q.—What do you think of Campbell's Early?

MR. STEWART: I would not recommend it. I have not been successful with it.

Q.—For a green grape how about Moore's Diamond?

MR. STEWART: It is not as large as the Niagara and the tendrils do not give enough curl. You have to tie it up with a heavy string. If you don't you will have the vine break off. It will not sell with the Niagara.

Q.—What about the Wyoming Red?

MR. STEWART: Probably one year in three you get it to bear well. It grows too much wood, and you have to strip it off or it will smother out.

Q.—It does well in the Burlington district. It is double the size of the Delaware and as good quality.

MR. STEWART: I would rather grow the Delaware.

SMALL FRUITS.

W. T. MACOUN, DOMINION HORTICULTURIST, OTTAWA.

After a few words of introduction the speaker proceeded to deal with the different varieties of small fruits.

STRAWBERRIES.

During the last twenty-five years we have tested probably six hundred main varieties of strawberries. During that time we have had a great many sorts which appeared promising for a limited time and then they failed. I may say that during the past ten years of all the new varieties we have tested, we have not found a single one to take the place of the older varieties, not a single one. I will give you now the names of those which have succeeded best with us, and I will just add a word or two on each of them: Bederwood, Splendid, Warfield, Senator Dunlap, Williams, Sample, Buster, Parson's Beauty. Of these the varieties which seem to be succeeding, or which are suited best for a wide area, I would mention the Senator Dunlap and Parson's Beauty. I know in Southern Ontario you are growing the Williams. We have not found that very successful in Eastern Ontario, and while undoubtedly it is one of the best up here, I should not care to recommend it for general planting all over Ontario. The Senator Dunlap seems to be the most popular in Canada to-day. I have had the opportunity of travelling over Canada from the Atlantic to the Pacific and the Senator Dunlap seems to have been the most successful. It is the most popular variety in places where they are easily grown and where they are not so easily grown. It makes any number of runners and these runners protect the crowns of the plant, or at least the leaves protect the crowns, and this variety comes through the winter better on the whole than almost any other sort that is being grown.

Another reason is on account of making so many runners you are nearly always sure of a good stand of plants, which of course is very important. The Senator Dunlap also keeps its size well to the end of the season. It is a good color and a heavy producer. I should like to say the Parson's Beauty in Western Ontario compares favourably with the Williams. I believe in many cases it would yield better than the Williams. It is a handsomer berry and has not so many white tips, and I believe on the whole I would take that in place of the old variety.

MR. ONSLOW: How do those varieties mentioned compare with the Williams for shipping?

MR. MACOUN: I would consider the Parson's Beauty as good a shipper as the Williams.

MR. HAMILTON: The Williams is going out rapidly in Clarkson. The Glen Mary is now the standard crop.

MR. MACOUN: We have not found that to be a shapely berry. It is large but irregular and rough looking.

Q.—Is the Parson's Beauty the same as the Gibson?

MR. MACOUN: We have not found it the same.

Q.—What would be the distinguishing features?

MR. MACOUN: Well, with us the Gibson is a darker berry, and a better quality than the Parson's Beauty.

Q.—Is the Senator Dunlap not too dark a color?

MR. MACOUN: No, it is a lovely shade of red which makes it very attractive. I have never heard it suggested before that it was too dark in color.

Q.—Does the Parson's Beauty not do better on heavier soil than light?

MR. MACOUN: Yes.

A MEMBER: I would like to say a word about the Glen Mary. It will stand the drought. The Sample was found to be a little soft, but we found those the most popular. The Senator Dunlap is grown a great deal, but we find it is apt to grow pretty small towards the end of the season. It has a tendency to grow black, and makes them look worse in the box than they really are.

MR. MACOUN: The point about the drought is a very important one. Strawberries vary more in different kinds of soil, I think, than any other kind of fruit. Some varieties cannot stand drought at all, while others stand it very well. Some do better on light soil, and some on heavy soil. The reason is they have entirely different root systems. Some have quite deep root systems while others have shallow root systems. The result is those which have shallow root systems suffer severely in the spell of hot dry weather. One cannot say really as definitely as one would like what variety of strawberry a person should grow.

GOOSEBERRIES.

Q.—What variety would you advise in gooseberries?

MR. MACOUN: I think perhaps the Whitesmith is the best variety of English gooseberry. We have not been successful in field culture in growing the English gooseberries. I would like to hear from anybody who has been spraying with lime sulphur, whether that continues a good remedy for gooseberry mildew. We have been spraying for some seasons but we find it is not entirely effective for gooseberry mildew on the English varieties.

MR. HAMILTON: I have not had any mildew on English gooseberries since I took to spraying with lime-sulphur. It is practically annihilated.

A MEMBER: I used it for five or six years and found it perfect.

Mr. Macoun: The American gooseberry is a productive fruit and averages a good crop if well cared for. It is, however, very important to have good foliage to protect the fruit from the sun, and unfortunately many let the currant worm destroy a large proportion of the foliage, and if the weather is hot the fruit suffers. Six bushes of Pearl gooseberry have averaged in five years at the rate of 12,402 lbs. per acre per year, or at 40 lbs. to the bushel, over 310 bushels per acre. The highest individual yield was in 1905, when five bushes of Pearl, six by four feet apart, yielded 75 lbs., or at the rate of 27,225 lbs. per acre, equal to over 680 bushels per acre.

The highest yield mentioned by Card in his work on Bush Fruits is at the rate of 450 bushels per acre, obtained at the Geneva Experiment Station, N.Y. He gives the probable range from 300 to 500 bushels per acre. Bailey gives the average as 100 bushels per acre, but we believe this is much below what is grown in Canada.

I would recommend the following varieties:

American.—Pearl, Downing, Red Jacket (Josselyn).

English (from experience at the Central Experimental Farm).—Companion, Eagle, Glenton Green, Queen of Trumps, Snowball.

English varieties usually recommended.—Whitesmith, Industry.

Raspberries.

The crop of raspberries, like most other fruits, depends largely on climatic conditions, and even though the best variety is planted, if the season is unfavourable or the plantation has not been cared for properly, the yield will be much lessened. As a rule it will be found that the more the crop can be increased by special care the greater the profits will be, the extra labour and expense made being much more than repaid for by the increased crop and additional revenue. A crop of raspberries, according to Bailey, ranges from 50 to 100 bushels per acre. Card found that the average yield of red raspberries estimated from the information received from 56 growers is about 69 bushels per acre. At the Central Experimental Farm the average yield of the Herbert raspberry for two years on one row 90 feet in length was at the rate of more than 205 bushels per acre, or about 6,586 lbs. From two rows, each 18 feet in length, or one row 36 feet long, the average yield for three years was over 229 bushels per acre, or 7,357 lbs. The average yield of the Brighton from two rows each 18 feet in length was over 175 bushels per acre, or 5,602 lbs. The highest individual yield was obtained from the Herbert in 1904, which produced 50 lbs. 12 oz. of fruit from two rows each 18 feet in length, or one row 36 feet long, which is at the rate of 10,234 lbs. per acre, or 319 bushels 26 lbs., estimating a bushel at 32 lbs.

While these large yields are from small plots, they show the possibility of increasing the average yield throughout the country very much.

For general culture I would recommend:

Red, *Early.*—King, Brighton, Count Marlboro.

Main crop.—Cuthbert, Herbert.

Yellow.—Golden Queen.

Purple.—Columbian, Shaffer.

Blackcaps.—Hilborn, Older, Gregg, Smith Giant.

Black Currants.

The following are the best:

Saunders, Collins Prolific, Buddenborg', Victoria.

Of those not yet on the market which are considered equal to or better than those above, the following are the best:—

Kerry, Eclipse, Magnus, Clipper, Climax and Eagle, and the Success for an early variety where yield is not so important as size and quality.

Topsy is very handsome and of good size and good quality, and ripens evenly, but has not been quite as productive as some others. Boskoop Giant is promising.

Q.—Can you tell us anything about the Boskoop Giant?

Mr. Macoun: Yes, I consider that most promising. Our bushes are not old enough yet, and I don't know of any one with a plantation old enough to compare it with the older sorts. Taking the younger bushes of three or four years of age the Boskoop Giant is one of the most promising black currants introduced. It is a very fine quality.

Q.—Is it not a little soft?

Mr. Macoun: Yes, a little soft.

Red and White Currants.

Of these fruits the best are:

Red—For general culture.—Pomona, Victoria, Cumberland Red, Red Dutch, Greenfield, Rankins' Red, Red Grape.

Where bushes are protected with snow in winter, and for the milder districts.—Pomona, Victoria, Cumberland Red, Wilder, Cherry, Fay and Red Cross. Perfection is promising.

White.—White Cherry, Large White, White Grape.

It is possible that under different conditions of soil and climate other varieties might do equally well.

Blackberries.

The blackberry is a more uncertain cropper than the currant, gooseberry and raspberry, as it suffers more in winter and is affected more by dry weather in summer. No really good crops of blackberries have been produced at Ottawa, the best yield being in 1895, when the Agawam yielded at the rate of 2,452 boxes per acre. The next best yield was in 1903, when the Agawam yielded at the rate of 1,979 boxes per acre.

Bailey, in his Horticulturist's Rule Book, gives the yield at from 50 to 100 bushels per acre, which at 32 lbs. to a bushel is from 1,600 to 3,200 lbs.

Those varieties most recommended for the fruit districts are:

Agawam, Snyder, Eldorado; and for southern section, Kittatinny.

THE USE OF FERTILIZATION IN APPLE ORCHARDS.

Dr. J. P. Stewart, Experimental Pomologist, State College, Pa.

The proper fertilization of an orchard is largely a local problem. It is no less a problem, however, because it is local. The same is true, to a marked extent, of many other orchard operations, not excepting cultural methods. It is true that of

late it has become a fashion among horticulturists to assume that the whole truth is known about cultural methods, that there is but one proper method for orchards and that all growers who do not follow it are either shiftless or ignorant. But the fact is, that even with cultural methods, the practice found best for one particular soil or location, or for one age of orchard or fruit effect, is by no means certain to be best for all others or even the best for the adjacent farm. In general, therefore, it appears that there are, at the present time, comparatively few horticultural principles or practices which are really exact or general in their application. Most of them seem to be quite subject to important exceptions, and hence usually they require some local modification or adjustment, if the best results are to be secured.

So it is with orchard fertilization. We know that it is likely to be important and we can now give approximate general directions for it. But when we come to the actual fertilization of a particular orchard, some local tests and local adjustments are usually desirable.

The Amounts of Plant Food Actually Taken Up by a Mature Orchard.

That there is an important need for fertility in any orchard that is actively producing and growing, there can be no reasonable doubt. The actual extent of this need can be approximated chemically by determining the average composition of apple wood, leaves, and fruit, and applying these figures to what may be considered good annual amounts of these products. This we have done both for apples and for a 25-bushel crop of wheat, with the results shown in Table I. The annual weights for apples are based on a yearly production of 100 pounds each of wood and leaves and 14 bushels of apples per mature tree. All these amounts are distinctly less than those actually observed and reported, but inasmuch as they give an annual yield of 490 bushels per acre of 35 trees, they are considered sufficient for the present purpose.

Table I.—Relative Plant-Food Draft of Wheat and Apples.

(In pounds per acre annually, based on American and German averages.)

——	Wheat Grain.	Wheat Total.	Wood.	Lvs.	Fruit.	Apple Total.
	lb.	lb.	lb.	lb.	lb.	lb.
Annual weights	1,500	4,200	3,500	3,500	24,500	31,500
Nitrogen (N)	30.0	43.7	11.3	25.6	16.2	53.1
Phos. acid (P_2O_5)	10.0	15.8	3.6	5.3	6.4	15.3
Potash (K_2O)	9.8	26.8	6.6	15.9	41.5	64.0
Lime (C_aO)	0.84	8.0	29.1	29.5	3.0	61.6
Magnesia (M_gO)	3.0	6.1	4.4	8.9	3.4	16.7
Iron (F_eO)	.....	.....	0.5	1.5	0.8	2.8

In the first place it will be noted that in total food draft the apples exceed the 25-bushel wheat crop in every constituent except phosphoric acid, and in it they fall behind only by half of a pound. Notwithstanding this fact the trees are usually able to maintain themselves much better and longer than wheat. This is probably largely because of their much longer season of root-activity, their more natural demands,* the annual return of most of the plant food in their leaves, and their

*This is especially marked in the case of the fruit as compared with the demands of the grain in wheat. For further discussion, see article by the writer in the Annual Report of the Pennsylvania State College for 1910-11, pages 447 to 449.

ability to curtail production for one or more seasons when conditions become unfavorable. Without going into details, however, it is quite evident that very important amounts of plant food are annually removed by an apple orchard. Scarcely any soil can furnish all these materials indefinitely in the amounts and times required, and unless proper assistance is rendered, there must come a time when production is materially reduced and off-seasons occur.

It is also interesting to note the relatively large amounts of nitrogen, potash, and lime, and the comparatively small amount of iron annually taken up by the apples. Nearly all the lime remains in the wood and leaves, while a larger proportion of potash is found in the fruit.

This large amount of lime seems to have some significance, so far as the wood is concerned, because, as shown later, in most of our experiments, its application has improved the growth. In view of the small amount of lime required by the fruit, however, its application should not be expected to materially affect the yields, and this corresponds with our field results. Moreover, the total effect of adding lime alone is surprisingly small, in comparison with the relatively large amounts that are taken up. Either these amounts are merely drawn in and deposited mechanically by the transpiration stream, and hence are largely without physiological significance, or else the average soil is still able to supply the lime needed.

With iron the case is very similar. This element is almost universally present in agricultural soils and the total amount required is so small that its addition can scarcely be expected to produce any important effect. This also is borne out by such experimental results as are now available.

From the large amount of potash carried by the fruit, one might suppose that its addition to the soil would be very important in improving yields, and this idea has been widely proclaimed, especially by those considering only the chemical composition of the fruit. As indicated later, however, it seems that most orchard soils are already sufficiently supplied with potash in available forms, and that the chief shortages occur in the nitrogen and phosphates. This is the case notwithstanding the fact that the latter materials are actually required in considerably smaller amounts.

From these facts it is evident that there is comparatively little relation between response and requirements in the case of plant food and that something more than knowledge of the chemical composition of the fruit and wood is needed before one can properly fertilize an orchard. Even with the additional knowledge of the composition of the soil, the problem is not much simplified, because it is impossible as yet to duplicate sufficiently the conditions existing in any soil.

A chemist may determine the total amount of plant food present, but he can not yet determine their actual availability to the trees with sufficient accuracy to be of much value. The practical and proper fertilization of an orchard, therefore, becomes an experimental problem, and its solution is dependent primarily upon the pomologist or horticulturist. In other words, the question is not so much what amounts of plant food are annually taken up, nor what amounts are present, but rather it is what responses are made when certain kinds and quantities of plant food are actually added to an orchard soil.

It is to get light on the latter question in connection with ten different types of soil that we have been working at the Pennsylvania Station since 1907. Altogether in the case of apples we have ten experiments on bearing trees and two on young trees, involving a total of more than 2,800 trees located in different parts of the

state, all of which bear more or less directly upon the present question. For the present, however, we shall call special attention to but three of these experiments, since they bring out most clearly the principal points involved.

Effects of Plant Food Additions to Orchards.

Some of the effects of adding plant food to orchards are shown in Table II. This table gives the yields obtained during the past five years in a 10-plot experiment with Baldwins, now 24 years of age, located on a Volusia silt loam in Lawrence County, north of Pittsburgh. In estimating the influence of the treatments the yields of the first year are excluded because they can never be materially affected by the applications of the first season. The yields are given in pounds and also in bushels per acre annually for the last four years.

Table II.—Influence of Fertilization on Yield (Johnson Orchard).

(Yields in pounds and bushels per acre, 1908-1912.)

Plot.....	1	2	3	4	5	6	7	8	9	10
	Check.	Nit. and Phos.	Nit. and Potash.	Check.	Phos. and Potash.	Comp. Fertilizer,	Check.	Manure.	Lime.	Check.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1908.....	90	528	237	446	571/2	759	211	278	558	106
1909.....	675	6,018	5,257	1,932	3,089	6,621	2,008	3,531	1,216	1,266
1910.....	2,575	3,265	1,622	3,168	3,552	2,108	1,629	6,149	3,185	3,505
1911.....	283	7,563	7,816	617	1,227	8,209	1,362	4,874	388	106
1912.....	1,024	1,225	696	1,382	1,385	189	1,226	6,698	741	474
Total four years	4,557	18,071	15,591	7,099	9,253	17,127	6,225	21,252	5,530	5,351
Bushels per acre annually.	136.7	542.1	467.7	213	277.6	513.8	186.7	637.5	165.9	160.5
Annual gain over check, Bushels per annum.....	*.....	377.9	293.5	.....	103.4	339.6	.....	463.3	—8.3	.....

In the first place, it will be noted that the checks, or unfertilized plots, have run fairly uniform, producing an average annual yield of 174.2 bushels per acre during the last four years. Lime alone (at the rate of 1,000 pounds per acre annually) has shown no improvement over the average check, and as a matter of fact it has averaged 8.3 bushels per acre less, a deficit that is doubtless largely or wholly due to incidental causes and natural fluctuations. The phosphate and potash combination has affected the yield here rather distinctly. This may be at least partly due to a possible advantage in the location, as indicated by the fact that its adjacent check is the highest producer among them and is averaging within 64 bushels of the phosphate-potash treatment. The growth on the latter plot, however, is nearly 3 per cent. less than the normal unfertilized plot, and its general appearance is not appreciably superior to that of the checks. It is evident, however, that these trees are still vitally in need of something, although it should be noted that they are receiving the fertilization commonly advised for orchards, largely on the basis of chemical analysis.

This need is being quite thoroughly met on the adjacent Plot 6, which differs from number 5 only in the addition of nitrogen. The mere addition of nitrogen

*The average check or unfertilized plot produced 174.2 bushels per acre annually during 1909-1912.

in this case has more than tripled the gain. Wherever nitrogen appears in the treatments very large yields are observed, and the foliage and growth of the trees are very satisfactory, the average gains in trunk-girth ranging from 25 to 90 per cent.

Plot 2, receiving nitrogen and phosphate only, at the present time shows a better gain than number 6, which receives potash in addition. This is directly connected with the almost complete crop-failure that occurred in the latter plot this past season, and it is also doubtless partly attributable again to natural fluctuations in yield. It shows, however, that no additional potash is needed in this orchard, so far as yields are concerned.

Phosphates are next in importance to nitrogen here, as indicated by the 42-bushel average deficit that occurs on plot 3 as compared with number 6, when phosphorus is omitted in the former, and also by the high yields on plot 2. Manure, as a result of the extra large crop of 1912 when most of the other plots were having an off-season, is now in the lead in this experiment, with the tremendous average yield of 637 bushels per acre annually for the past four years. This gives an annual gain over the check of 463 bushels per acre, which is a very satisfactory exchange for 12 tons of manure. This benefit from manure is doubtless largely due to its nitrogen content, the proof of which becomes more evident later.

Time Required for Results to Appear. It is a common impression that long times are required to determine the value and kind of fertilizer needed for an orchard. It will be noted here and in the following experiment, however, that both these facts were thoroughly evident in the season immediately following the one in which the fertilizers were first supplied. In other words, both the value of fertilization and the kind of fertilizer needed were clearly evident in these two cases within a single year after the first application, and the conclusions formulated then have not been materially changed by the results of the four or five additional years that we now have. In most other cases, also, where these facts did not appear in the first two or three seasons of bearing they have not appeared in the five or six years now available. This is of special importance in connection with the local tests recommended later, though in them we advise at least three years of trial, for the sake of a wider margin of safety and greater stability in the resulting conclusions.

Results from the Brown Orchard.

This experiment is located in Bedford County on De Kalb stony loam—a residual, foot-hill soil chiefly of sandstone origin, which is commonly used for orchard purposes. The trees in this case are York Imperial, now 24 years old. It involves the same treatments as those in the Johnston orchard and four others besides —those in plots 6, 9, 11, and 12. It also was started a year earlier, in 1907, and the results of that season are excluded in the present table for reasons stated above.

TABLE III.—INFLUENCE OF FERTILIZERS ON YIELD (BROWN ORCHARD).

(Yields in pounds per plot, 1908-1912.)

Plot Treatment.	1908	1909	1910	1911	1912	Totals.	Benefit over Normal.	Annual Gain over Average Check.*
						lb.	%	Bu. per A.
1 Check	2,402	25	4,052	1,588	453	8,520	.....	.....
2 Nitr. and Phosphate	4,153	588	5,920	2,219	7,281	20,161	204.8	376.5
3 Nitr. and Potash	3,079	78	3,838	1,567	5,402	13,964	196.6	259.2
4 Check	754	9	470	1,260	309	2,802	.....	.....
5 Phosphate and Muriate	1,014	252	2,381	1,643	616	5,906	79.9	75.2
6 Phosphate and Sulphate,	292	266	1,368	1,299	356	3,581	—4.8	10.1
7 Check	254	192	1,115	1,568	1,117	4,246	.....	.....
8 Nitr. Ph. and Potash	1,219	454	2,436	3,241	4,931	12,281	208.7	253.7
9 Nitrogen	863	1,575	120	3,082	1,614	7,254	96.—	113.0
10 Check	458	515	787	1,448	222	3,430	.....	.....
11 Acid Phosphate	104	892	787	794	64	2,641	—25.9	—16.2
12 Raw Phosphate	100	124	581	703	123	1,631	—55.9	—35.5
13 Check	266	257	2,096	498	727	3,844	.....	.....
14 Manure	621	1,947	778	7,334	1,117	11,797	273.9	240.2
15 Lime	152	160	1,029	1,060	288	2,689	9.0	—14.8
16 Check	246	36	943	387	166	1,778	.....	.....

In general we have the same types of results here as in the preceding experiment—large gains from nitrogen, phosphates and manures, with relatively small effects from potash, and again no advantage at all from lime. There are greater irregularities in this experiment, owing somewhat to its greater size, but chiefly due to the presence of a wood on the mountain side above the first check plot, from which the latter is separated by a single row of trees. The leachings from the floor of that wood have acted much like a nitrogenous fertilizer, and as a result the trees nearest the woods, although of the same age as those farther down, are considerably larger, thus accounting for the greater yields of the first two or three plots. This influence practically disappears, however, before the fourth plot is reached, as shown by its low yields—those of a typical check.

The differences observed in the last two columns are due partly to these irregularities, partly to a certain amount of leaching and cross-feeding on the part of some of the checks in spite of separation rows below each treated plot, and partly to a different method of calculation. In one column the benefit is figured on the basis of the normal production of the immediate plot concerned, which method is supposed to eliminate soil irregularities to the greatest possible extent. When the adjacent checks are being benefited by leachings or cross-feeding, however, this method fails to show the full benefit due to the treatment. This failure is especially evident in plot 6, which shows an apparent negative influence in the "normal" column and a positive influence of ten bushels per acre annually in the column based on the average check. The apparent negative influence is due directly to extra yields in the adjacent check, plot 7, which is apparently receiving some benefit from plot 8 as a result of cross-feeding. The same thing appears in the negative figures shown by Plots 11 and 12, though they are not entirely eliminated by using the average check as the basis. The average check, moreover, is not entirely free from the cross-feeding influences, since it only distributed the extra yields, and hence it is probable that

*The annual gains over their "normal production" are indicated in plots 2 and 3. Their annual yields were 564.5 and 391 bushels per acre respectively. The average check, omitting No. 1, was 3,220 lbs. per plot, or 90.16 bu. per acre annually.

the negative figures in plots 11, 12, and 15 of the last column merely indicate that these materials have no definite influence when applied by themselves, and the further deficits are attributable simply to natural fluctuations.

Returning now to the results themselves, and especially to those treatments not included in the preceding experiments, we may note first that muriate of potash in plot 5 has given much better gains than the sulphate in the adjacent plots. This is contrary to the results of the Massachusetts experiment, but similar results are now being shown in all of our own experiments wherever the comparison occurs. Hence the differences in the Massachusetts experiment would seem to be due to something other than the difference in potash carriers. At present, therefore, we believe that the muriate is at least as efficient as the sulphate, and in view of the facts that it is cheaper, more soluble, and much less subject to "caking" in the mixtures, we are now using and recommending it for apples.

In plots 11 and 12, and other similarly treated plots in our experiments, we see the apparent futility of attempting to materially improve yields by applying phosphates alone. This is not due to the fact that phosphates are not needed, nor can it be largely attributable to the absence of cultivation, as may be seen by comparing the results in plots 9 and 2. Nitrogen by itself in No. 9 shows an annual gain of 96 per cent., or 113 bushels per acre, but when phosphorus is added in plot 2, these benefits are more than doubled. Phosphorus as usual, therefore, appears to be the next in importance after nitrogen in improving yields.

The Permanence of Fertilizer Influence: It is another fairly common impression that the influence of fertilizers is transient, and that, even where there effect is favorable at first, this effect soon wears out and may leave the soil worse than before. This evidently depends very largely on the character of the fertilization, and in this respect apples are not different from other crops. If the gains are induced by some caustic action of such materials as gypsum or lime when used alone, this may actually be the final result.

On the other hand, it should be noted here that in plots 2 and 3 and 8, where definite plant foods are being supplied, the effects of fertilization were greater than ever before in 1912, the sixth year of the experiment. The steadiness and regularity of the increases also are especially notable in plot 8, which shows a distinct gain in every year except 1909, and in that year the yield would have been fully 1000 lb. greater had there been sufficient moisture available to properly develop the fruits that were actually present.

In plots 2 and 3, the fertilization has not been complete and also the yields have been so large in the even-numbered years that it was impossible to prevent some alternation with lighter crops in the odd years. This same general condition is evident to a considerable extent in the Johnston orchard. In other experiments, however, and especially in one primarily on cultural methods in the Fasset orchard, with proper fertilization and with crops ranging between 300 and 600 bushels per acre, we have steady increases on Baldwins and Spies similar to those in plot 8, which extended over a period of five years before any increase appeared.

The unusual size of the 1912 crops on plots 2 and 3 in the Brown experiment should also be noted. While their adjacent checks, 1 and 4, were showing an average yield of 73.2 bushels per acre, plots 2 and 3 were producing the tremendous average of 1,217.5 bushels per acre, and 1,006 bushels of this were picked fruit. The terminal twig-growth of the checks, also, would scarcely average half an inch for the season, while that of the fertilizer plots, in spite of their enormous crops, averaged from 6 to 8 inches, with frequent terminals running up to 2 feet.

And all these differences were brought about solely as a result of differences in fertilization. The spraying, pruning, soil management, variety and age of trees, and all other visible features were just the same on the checks as on the fertilized plots.

Results in the Tyson Orchard.

In the two preceding experiments, we have seen very large annual gains resulting from certain fertilization, particularly that rich in nitrogen and phosphorus, regardless of whether these elements were carried in manure or in commercial forms. In these cases, also, the gains from potash were relatively small or entirely absent. Thus far in the Tyson experiment, so far as yields are concerned, we have practically the reverse conditions.

The trees in the latter experiment are much younger, being now but fourteen years of age. The varieties are York Imperial and Stayman Winesap, the latter having being top-worked on certain York rows about six years after planting. The soil is a relatively heavy silt loam, and tillage and annual cover crops have been maintained near the trees practically uniformly since the orchard was started. The annual growth and general appearance of all the trees in this experiment are much better than those of the average check trees in the two preceding experiments. Practically no fruit had been borne by these trees, when our experiment was started in 1907, and there has been but one fairly full crop since then—that of 1911. The treatments are the same in the Brown experiment and the results are shown in Table IV.

Table IV.—Influence of Fertilization on Yield and Growth in Experiment 215 (Tyson Orchard.)

(Yields in pounds per plot, 1908-1912.)

Plot Treatment.	1908	1909	1910	1911	1912	Totals	Benefit over Normal.	3 Year Annual Gain over average Check.	Growth Gain over Normal 6 year.
							%	bu. per acre.	%
1 Check	14	95	346	2,053	549	3,057	.....	.....	.....
2 Nitr. and Phos.	26	73	301	2,277	464	3,141	8.0	12.2	7.4
3 Nitr. and Potash	43	115	418	3,043	542	4,161	50.9	43.0	17.7
4 Check	21	54	260	1,555	719	2,609	.....	.....	.....
5 Phos, and Mur.	26	146	476	2,828	495	3,971	46.1	36.5	8.1
6 Phos. and Sulf.	61	179	483	2,352	975	4,050	43.2	36.8	2.3
7 Check	18	45	235	1,777	862	2,937	.....	.....	.....
8 Comp. Fertilizer	21	74	300	2,885	190	3,470	26.7	22.9	12.7
9 Nitrogen	17	83	229	1,746	551	2,626	3.5	—4.7	7.9
10 Check	17	89	150	1,579	504	2,339	.....	.....	.....
11 Acid Phos.	3	43	153	1,359	655	2,213	—9.8	—15.8	4.4
12 Raw Phos.	4	62	164	2,010	842	3,082	20.0	11.4	0.8
13 Check	31	46	103	1,886	615	2,681	.....	.....	.....
14 Manure	15	52	190	2,333	262	2,852	4.1	4.—	14.6
15 Lime (and Fertilizer)	27	86	186	1,765	1,113	3,177	13.4	13.1	—1.6
16 Check	10	76	115	1,922	739	2,862	.....	.....	.....

As already indicated, the relative youth of these trees makes both their yields and differences much less than those in the preceding experiments. With increasing age, it is probable that some of the results may be different, especially in view of the relative growth that is now being made under the different treatments. At present, however, certain facts are of interest.

In the first place, the practical failure here of both manure and nitrogen is quite remarkable. The regular annual application of 12 tons of stable manure, in this case, has resulted in an annual gain of less than four bushels of apples per acre. During the same time, nitrogen alone has shown no gain at all, and nitrogen and phosphates, which were so effective in the preceding experiments, here show annual gain of only 12 bushels per acre—not enough to pay for the treatment.

Potash, on the other hand, in direct contrast to its effect in the experiments above, here shows a distinct gain in yield wherever it is applied. The best of these gains—in combination with nitrogen—is only 43 bushels per acre annually, but this is more than a 50 per cent. increase over the normal yield, and it shows a fair profit over the cost of treatment, besides giving over 17 per cent. of an increase in growth. Potash applications, therefore, have evidently been of value in this orchard, even when those of manure and of nitrogen and phosphates were largely failing.

The Action of Manure *vs.* That of Commercial Fertilizers.

The above facts, taken in connection with those shown in the two earlier experiments, indicate that the plant-food action of manure is practically identical with that of a commercial fertilizer rich in nitrogen and phosphates. It also apparently indicates that the potash in the manure may be less readily available than that carried in commercial forms. The old controversy over the relative value of manure and commercial fertilizers, therefore, is without any particular significance so far as plant food is concerned. Either type of fertilizer may be successful or either may be a failure, depending upon the particular conditions involved.

The manure, however, often has some additional value, due to its mulching effect. This, of course, cannot be duplicated by commercial fertilizers alone, though it may be duplicated by any other kind of a mulch, as has been shown especially in our experiment 339 in Bradford County. The matter of availability also must often be considered, and it is for this reason that the relation between manure and nitrogenous fertilizers should be well understood. Besides this, it sometimes happens that large and regular applications of manure result in a distinct increase in the amount of blight, and also in an undue increase in the size of the fruit and in the amount of punky pitting in the latter. In such cases, a reduction in the applications, or the partial or the complete substitution of a proper commercial fertilizer is desirable.

A Summary of Fertilizer Influences on Apples.

It is impossible in the present space to consider all our experiments singly, to the extent done with the three just considered. Before passing to the last stage of our discussion, however, it seems desirable to present a very brief tabular summary of the fertilizer influences shown in six of these experiments, including the three just considered. This summary shows the calculated influences of the various fertilizer elements on four important characteristics of apples, viz., their yield, color, average size, and the amount of wood growth. The relative values of the different elements during a five-year period, in terms of per cent. of benefit over the normal results obtained without fertilization, are shown in Table V.

TABLE V.—INFLUENCE OF FERTILIZER ELEMENTS ON APPLES.

(Average benefits over normals, 1908 to 1912.)

——	Yield.	Colour.	Size.	Growth.
(a) Experiments 215, 216 and 220:	%	%	%	%
Nitrates in combination	62.7	—11.0	—0.7	10.43
Nitrates alone	32.5	—12.7	—4.3	15.51
Phosphates in combination	20.2	— 2.1	0.3	2.28
Phosphates alone	—10.7	2.7	—0.6	2.45
Potash in combination	15.1	2.7	5.8	3.67
Complete fertilizer	78.3	—15.4	5.2	17.67
Manure	75.9	—11.4	5.8	29.07
Lime alone	— 8.24	— 0.3	—2.0	6.31
(b) Experiments 336, 338 and 339:	1908–12	1909–12	1909–12	1908–12
Nitrates in combination	74.5	—12.7	—0.4	27.00
Phosphates in combination	33.5	— 2.8	4.9	—0.23
Potash in combination	— 3.6	1.4	7.1	2.79
Complete fertilizer	80.5	—15.6	5.2	29.63
Manure	168.8	—15.9	25.2	37.34
Lime alone	29.8	— 5.4	15.9	15.48

Without going into details it may be noted that in general the same influences that have materially increased the yields have also increased the growth. In other words, our best growing plots have as a rule been our best fruiting plots. On sound, healthy trees, this will generally be the case unless either occurs to an abnormal extent, in which case the other may be somewhat reduced. Mild injuries may also stimulate yields at the expense of growth.

In Table V., the most marked exception to our rule above appears in the case of the phosphates, especially in the lower section of the table. This may be connected with the fact that the old wood especially is very low in phosphoric acid, as shown in Table I., and our present definite growth determinations are based upon increase in trunk-girth alone. On twig-growth, however, our observations indicate that phosphate additions have been very helpful, particularly in the Brown orchard. This also tends to bring it in line with our rule above.

THE CONTROL OF AVERAGE SIZE. So far as fertilization is concerned, manure and potash are the only materials that have consistently benefited size. The manure influence is doubtless very largely due to its mulching or moisture conserving effect, since moisture makes up about 84.6 per cent. of this fruit on the average,* The potash influence, also, so far as it is a definite benefit, is probably brought about through the same medium, inasmuch as potash is credited with some ability to increase the osmotic power of the cells, thus enabling them to compete more successfully for whatever water is present.

There is also a distinct possibility that the apparent benefit of potash on size may be largely due to the fact that it is associated with much lower yields than the other materials, especially nitrogen. Conversely, their failures to increase size may likewise be due to their association with markedly increased yields.

This brings out the general proposition to which we have called definite attention elsewhere, that with a normal moisture supply the dominant influence controlling size in apples is the number of fruits on the tree, after this number has passed a certain optimum or "critical point." This point, however, is relatively

*See Table XVIII. in the writer's article in the Annual Report of the Pennsylvania State College for 1910-1911, page 435.

high, our data showing that even on trees up to 15 years of age, little or no correlation appeared until the number of fruits had reached 1,400 or more per tree. Above this point proper thinning is the most important means of increasing the size of the fruit. Below it, the size can usually be markedly affected by moisture supply, cultural methods, manure, and possibly by fertilizers—especially those rich in potash. The latter factors may also co-operate in such a way as to materially raise the critical point. In general, however, proper thinning and moisture conservation are the most important means of improving fruit size.

The Control of Fruit Color. In Table V., it will be observed that none of the fertilizer treatments have resulted in any marked improvement in color. Slight and irregular benefits are shown by potash and some of the phosphate applications, but nothing of any importance. The same is true of iron applications so far as experimental evidence is concerned.

These facts again lead up to the general propositions that color in apples can not be materially increased by fertilizer applications, and that the red colors of apples are essentially dependent upon maturity and sunlight. Conditions that tend to increase one or both of the latter factors, such as late picking, open pruning, light soils, and sod culture, tend to increase the red color. Opposite conditions decrease it.

These propositions make it clear why the nitrates and manure apparently injure color. It is simply done by retarding maturity and diminishing the available sunlight as a result of the increased density of foliage. To determine the truth of this, in 1911 we left the fruit on the nitrate plots in the Johnston orchard, until it had reached approximately the same degree of maturity as that attained by the checks when their fruit had to be picked on account of dropping. The delay required was fully three weeks—from September 29th to October 19th—and even then the later fruit picked much harder than that on the checks, besides showing a much lower percentage of drops. The amount of color on the nitrate plots at the later date was actually greater by 10 per cent. than that shown on the checks at their picking time.

The occasional marked increase on color as a result of spraying is largely explainable on similar grounds. The sprays reduce the worminess and thus enable the fruit to remain longer on the tree. It also may reduce somewhat the amount of foliage as a result of spray injury, thus permitting more light to reach the fruit. In general, however, in improving color, chief reliance must be placed on those methods that tend definitely to secure fuller maturity on the trees and to get the maximum amounts of light to the fruit.

Applying Present Data to Individual Orchards.

In the three experiments discussed separately above, it was noted that the materials found most valuable in the first two were failures in the third, and *vice versa*. In still others we might show cases where no form of fertilization has yet shown a profit. These and other cases prove conclusively the local nature of the problem. Hence not even the experiments of others can offer more than general advice on the fertilization of a particular orchard.

This advice can doubtless be made more exact after a personal examination of the orchard concerned, by one who is familiar with orchard fertilization work, or it may be done with greater certainty if the owner will give attention to some of the more important characteristics of orchards needing fertilization. The latter are best observed in late summer and fall.

In general, the characteristics of the orchard that is certainly in need of a fertilizer are those of starvation. They are usually sufficiently familiar to need no extended description. They are found most commonly in the older orchards that have once borne well, but no longer are doing so, though still fairly free from important diseases or improper drainage. The foliage is sparse and pale in such orchards, and the annual growth stops early and averages short—often no more than a half inch, and from this it may range up to two or three inches. In each cases, one can usually apply fertilizers fairly liberally with practical confidence of profits, providing the varieties and other handling are right. Even in such an orchard, however, it is advisable *to leave a small typical portion unfertilized* to really determine the value of the treatment.

Under opposite conditions, such as obtain in most young orchards, or in any orchard that is still growing and fruiting well and retaining its foliage until late in the season, fertilization is much less likely to show a profit. Even in such cases, however, there is often enough probability of benefit *to warrant some trial of fertilization, but only over a relatively small area,* and with most of the orchard left unfertilized as a check.

These trials are especially necessary in the intermediate orchards—those on the zone line between the two extreme types just described. Occasionally this intermediate type of orchard will respond very strongly to fertilization without necessarily showing the characteristic marks, as is essentially illustrated in the Johnston orchard.

A General Fertilizer Recommendation for Apples.

For preliminary use in such cases and for permanent use on the part of those who are unable to carry out such a local test as is shown later, we are now recommending the general fertilizer indicated in Table VI. The fertilizers are stated in amounts per acre rather than in amounts per tree, because of the varying numbers of trees that are planted on an acre. The amounts per tree for any particular case are readily obtainable, however, by dividing the present amounts by the given number of trees per acre. With young trees the amounts may be reduced approximately in proportion to the area covered, making this area correspond with that of the roots so far as possible.

Table VI.—A General Fertilizer for Apple Orchards.

(Amounts per acre for bearing trees.)

Nitrogen. 30 lb. (N.)	Phosphoric acid. 50 lb. (P_2O_5)	Potash. 25 to 50 lb. (K_2O)
Carried in: 100 lb. Nitrate and 150 " D. Blood, or in 150 lb. Ammon. Sulphate.	Carried in: 350 lb. Acid Phosphate, or in 200 lb. Bone Meal, or in 300 lb. Basic Slag.	Carried in: 50 to 100 lb. Muriate, or in 100 to 200 lb. low-grade Sulphate

For young orchards, reduce these amounts in proportion to area covered.

This table means that a fertilizer carrying about 30 pounds of actual nitrogen, 50 pounds of actual phosphoric acid (P_2O_5), and 25 to 50 pounds of actual potash (K_2O) should be applied on an acre of bearing trees. Where potash is not known to be lacking the smaller amount may be used, or after a little testing it may be even omitted entirely. With the smaller amount of potash, the essentials of the present combination are carried in 500 pounds of a 6-10-5 fertilizer or its equivalent. In the usual ready-mixed fertilizers the nitrogen is likely to be carried in ammonium sulphate, with which some liming may be necessary if many applications are made, and especially if leguminous cover crops or permanent covers are desired. In special or in home-made mixtures the various elements may be carried in any of the materials indicated on the table.

In our work the nitrogen is carried in the combination of nitrate of soda and dried blood indicated in the table. This combination carries about equal amounts of nitrogen in each material, and it thus gives a quick action as well as one that is prolonged well through the season. The nitrogen, being the costliest and most active ingredient, requires close watching and possible variations in amount in order to get the most out of it. It may also be secured, wholly or in part, by the use of stable manure or leguminous plants where they are available. With the other carriers indicated in the table we have very little evidence on their relative values as yet, and hence those that are actually least expensive or most convenient should be chosen. All applications should be made annually, subject to the variations indicated below.

Time and Method of Application.

The time of application we believe to be of distinct importance, especially in the case of nitrates. While our evidence on this is by no means complete, yet there are good indications that nitrates can easily be applied too early in the season and thus be wholly lost to the trees. Other evidence leads to the opinion that distinct harm may result from their application about fruit-setting time, especially in the case of the peach. We feel, therefore, that the nitrates should be applied not earlier than petal-fall in apples and probably not later than the middle of July. In general, about the middle of this period should be very good, though some of our most striking results have come from applications made as late as the 8th of July.

With the peach, in Missouri, Dr. Whitton reports that the time of application is very important and that very large increases in yield have been obtained from moderate quantities of nitrate of soda alone when "applied at the right time."* This is considered to be "after the main length-growth has taken place in early summer." Such applications kept the trees from going into the rest period too early, and maintained a green and healthy condition throughout late summer and autumn without renewing the growth in twig length. It may also be noted that in the English work, at the Woburn Experimental Fruit Farm, July applications proved beneficial, while those made in February were of no avail.

An incidental advantage of the delayed application appears in the fact that it gives an opportunity to vary its rate somewhat in accord with the size of the crop set on the trees. When the crop is light much smaller applications are required, because of the natural tendency of the trees to develop a sufficient number of fruit buds in the off season. Proper utilization of this fact should save much in a series of years and also enable one to secure the maximum return for the fertilization applied.

*See Proceedings of the Society for Horticultural Science, 1911, p. 37.

In the case of the mineral ingredients, with their lower solubility and slower action, the time of application is less important. Some of the most careful observers in commercial work regularly apply their phosphates and potash in the fall on their peach orchards, and believe that this gives best results. Thus far, however, we have felt that the time of application for the minerals is of relatively little importance since they are rather quickly fixed in the soil, in any case, and they do not leach readily. We, therefore, apply them along with the nitrogen at the time that we consider best for it.

The method of application that we have followed is merely to scatter the fertilizer or manure broadcast over the surface of the ground, taking care not to get it too close to the tree trunk, where there are few absorbent roots, and extending the applications well out beyond the spread of the branches. To conform more closely with the distribution of feeding roots, the rate of application is made heaviest in the central part of this area, or in general it is applied heaviest under the outer two-thirds of the spread of the branches. This fertilization may either be left on the surface to be washed in by the rains or it may be harrowed or lightly plowed into the soil. With all this done, it should be remembered that the fertilizer applied in any given season can hardly materially affect the yield of that year, since the fruit buds are formed in the latter part of the preceding season. Important results, therefore, should not be expected before the following season, at the earliest, and as indicated in some of our experiments, they may not appear until considerably later and still prove of value.

Determining the Actual Needs of an Orchard.

The general fertilizer formula indicated above is for use only until the exact needs of the particular orchard can be determined. In other words, it is intended only to meet the immediate demands. If, in the meantime, one wishes really to answer the question of how to fertilize his own orchard he can do so by following the plan outlined in Table VII. This plan is especially adapted to the needs of commercial orchardists and to "community" tests on the part of the smaller growers.

Table VII.—Plan for Local Orchard Fertilizer Test.

(Pounds for a mature tree in bearing.)

1. Check (Unfertilized).
2. Nitre, 2½ lb.; Dried Blood, 3½ lb.; Acid. Phos., 10 lb.
3. " 2½ "; " " 3½ "; Potash, 2 lb.
4. Acid Phosphate, 10 lb.; Potash, 2 lb.
5. Check.
6. Nitre, 2½ lb.; Dried Blood, 3½ lb.; Acid. Phos., 10 lb.; Potash, 2 lb,
7. Same as VI., plus Lime, 12 to 25 lb.
8. Manure, 400 lb.
9. Check.

This plan should be located in a typical part of the orchard, and should include not less than five average trees of the same variety and age, in each plot. All the trees should be labeled and carefully measured at a fixed point on the trunk, and definite records of their growth and yields should be kept for at least three years. Frequently good indications of the orchard's needs may be obtained in less time than this, as shown above in the Johnston and Brown orchards, but at least this amount of time should be allowed and more should be used when necessary.

The same time and methods of application and other precautions should be followed as described above. The materials are indicated here in amounts per

bearing tree instead of per acre as above and the same reductions should be made for younger trees. In other words, if only a third of the ground is to be covered, then only about a third of these amounts should be used, if the rate of application is to be kept within proper bounds.

These general precautions, together with the exercise of proper judgment on the part of the grower, are entirely sufficient to carry this plan to a successful conclusion and definitely settle the fertilizer needs of any ordinary orchard within a few years. If additional rules and precautions are desired, however, they can be found in the Annual Report of the Pennsylvania State College for 1910-11, pages 409-11. In addition, it should be remembered that an orchard may not show the need of a fertilizer when young, but may develop this need later, especially when heavy bearing is reached. This means that the cases that appear negative at any one time may often need further tests and attention later.

Q.—What would be the relative cost of manure?

PROF. STEWART: We put on twelve tons of manure to the acre, and we put on a commercial fertilizer in this experiment which would cost us about $15 to $18 per acre. I do not know what manure costs. It costs us anywhere from $1 to $3 or $4 per ton. It is such a variable thing. It is twelve tons, and that will give you the relative cost. However, the fertilizer that we are now recommending, based on the results of these experiments, can be made up for about $10 an acre, and if one can get his nitrogen by means of cover crops or possibly by alternating with manure he can reduce that to perhaps $4 an acre for the phosphoric acid and the potash.

Q.—Was there any cultivation?

PROF. STEWART: It was in a variety of conditions. It was without any cultivation whatever, the fertilizer being merely put on the surface of the ground and being washed in by the rain, and yet we got those gains. There was no cultivation uniformly throughout, however.

Q.—Was it sod?

PROF. STEWART: Yes, though it was not a particularly dense growth. There were Baldwins 24 years old, and they were practically occupying the ground.

Q.—When applying a large amount of nitrogen have you noticed any difference in the color of the fruit?

PROF. STEWART: As a general proposition if the fruit is picked early there is a marked reduction in the color, but if you let the fruit stay on the trees until it reaches the same state of maturity as occurs in the checks much before, you can get practically the same amount of color in nearly all varieties. We tested that matter thoroughly and we found that the retardation in maturity due to nitration was fully three weeks, and we found it had a higher color, actually an increase in color. So it is a question of the relative maturity. Nitration delays maturity and in that way it affects the color. It is not a question of being directly opposed to color, but it reduces color indirectly by retarding maturity, and if you pick it at the same time your nitrate fruit will be much greener than the other.

Q.—I notice in the manure the percentage or average is higher.

PROF. STEWART: I can explain that very easily. The percentage of benefits is figured on the normal production of the manure applied so and the normal production between this and the manure is based on the two adjacent checks. You will notice check "13" has only 3,800 pounds of fruit and check "16" has 1,700. They are relatively low checks, so that the normal production of this manure plot

we would figure would be relatively low, and consequently its actual production is based on that relatively low normal production. (Indicates on chart.)

Q.—You say that was a much younger orchard? Do you think that accounts for the results?

PROF. STEWART: Undoubtedly it has a bearing, but we have got other orchards that are younger that are responding pretty well, and other orchards that are older that are not responding as well, so that matter of age is another matter that has a bearing.

Q.—Is it possible by analyzing the soil to know what is the best fertilizer?

PROF. STEWART: Not very possible. You can get some idea. If there is something very deficient you can find it out by chemical analysis, but the way to get at it is to ask the trees.

Q.—Will this refer to stone fruits as well as apples, or is there a different requirement there?

PROF. STEWART: Really I am not prepared to answer that, because our experiments on peaches, which is the only stone fruit we are working on, have not gone far enough to afford a basis, and I do not like to answer things without any basis for it, because they generally come out wrong when you do. I will just hazard a guess. My opinion is this, that it makes more difference as to the kind of soil your peach orchard is grown on, and the previous treatment of that soil on the question of the value of fertilizer and the kind of fertilizer than the fact that it is a peach tree. The requirements of a peach tree and an apple tree are much more similar than the soil and previous treatment of soil are.

Q.—Would potash improve the color?

PROF. STEWART: It does not improve it. You have seen the color results from potash. It showed there was one-half per cent., or one-half of one per cent., less color on potash. The amount is so small that it is negligible, and it seems to indicate to me that potash has not affected it. If it was one or two per cent. above I would say that potash had not affected the color because the effect is too small not to charge up to accident.

Now, my net conclusion from these things which I have just gone over with you, and also from a study of all our other experiments, is that orchard fertilization is primarily a local question or local problem. However, do not get it into your minds that fertilization is not an important matter when it comes to fruit production. Our first chart shows that it is bound to be an important matter, and the next two charts show the field results prove it to be an extremely important matter, but it is a matter to be settled locally. People say they have not time to make these tests themselves, and so it is up to us as experimental station men to name your formulæ. The results I have given you are based on six years' work on this question.

Q.—What is a satisfactory growth?

PROF. STEWART: Of course that varies with the size of your tree and the number of limbs. I do not know.

Q.—In a young orchard with small trees?

PROF. STEWART: I do not know what a satisfactory growth would be. Three or four feet would be surely satisfactory in a young orchard.

Q.—It would depend a great deal on the variety?

PROF. STEWART: Yes, and the general situation.

Q.—You have not said anything about the use of cover crops?

PROF. STEWART: That will come up in connection with my address to-morrow.

My ideas on cover crops have suffered a shock in the last few years. However, I will tell you about that to-morrow.

Q.—How about the cover crop ripening up the wood for the winter?

PROF. STEWART: It will do that; but right along that line I might say that nitrogen will prolong the growth three or four weeks or a month. They seem to stand the winter without being wrapped up so early with us. It might not be so with you. I was surprised to find that nitrogen, which prolongs the growth so much, should not result in winter injured trees, but it has not.

Q.—What is the best cover crop you have tried?

PROF. STEWART: The cover crop that I think is best now is the hairy vetch, and then one or other of the clovers—crimson or red. It depends on your conditions. If the hairy vetch will come through the winter without winter killing to any great degree, I would certainly favor it in my orchard over anything else, because it is such an extremely low moisture retainer, and it is also a good nitrogen gatherer. As a basis for a mulch treatment the hairy vetch is a wonder.

Q.—Do you find absolutely clean cultivation year after year dries the ground out a great deal more than where the cover crop is put in?

PROF. STEWART: Well, that condition has not developed very greatly with us in our experiments; that is, the difference between the clean tillage and the cover crop. That merely applies to our own experiments, and it might not apply to your conditions here. It might be that you need that humus. All theory is in favor of cover crops, but all I can say is that our experiments have not shown what theory would have indicated.

Q.—Do you feel safe in using nitrogen fertilizer on young apples, such as Spies?

PROF. STEWART: We are using the fertilizer on apples, and have not had a winter injured twig.

MR. BROWN: I have a few trees this year that are in close proximity to heavy supplies of nitrogen, and I have got very poor fruit. It is green fruit, and is not matured enough to pack.

PROF. STEWART: That is a very important point in reference to color. A person will simply have to vary his nitrogen supply with the variety, and if he finds that the nitrogen is affecting his color too much he will simply have to reduce the nitrogen. That is about the only way out of it.

Q.—Can you hasten their ripening any?

PROF. STEWART: You can retard their ripening. Phosphoric acid and potash ought to hasten maturity a little bit, but their influence in hastening maturity in the apple has been comparatively small with us.

Q.—In one of your experiments you said the manure increased the yield because of the moisture?

PROF. STEWART: Undoubtedly.

Q.—Wouldn't the application of water irrigation have a much greater effect than some of the fertilizers?

PROF. STEWART: It might. It could not have a far greater effect than some of these fertilizers have had, because the trees were broken down as it was.

Q.—Do you think there would be any more benefit by applying lime to heavy clay land than the results you have shown us?

PROF. STEWART: Well, one of these charts is on a clay loam, quite a heavy soil. That is the one that shows a little benefit from the lime. It is possible it

would have a greater effect on heavy soil than it would on light, but the results have not been sufficient to enable one to make a straight statement to that effect.

THE PRESIDENT: I am sure you have all enjoyed the address by Professor Stewart. He has gone into the matter very fully, and I am sure it has been a great benefit to us to have had him here this afternoon. Professor Harcourt will follow up this discussion now.

PROF. R. HARCOURT: I would like to say how pleased I was to hear Professor Stewart emphasize so magnificently the need of experimenting on our own ground. We find that need absolutely in our case throughout. It is impossible for us to advise a man how he should fertilize his ground for an orchard or for other crops by taking the results of any analysis or any description he may give to us of his soil. We get so many letters of that kind that I have a typewritten sheet written out to answer those letters. I have the form of experiment that we advocate using so that each man may let the particular crop he wants to get answer the question itself, and let it answer the question from his own soil. We give a general type of experiment that can be used in that way, and I say a few words of generalities and inclose this sheet along with it, and it saves me a lot of writing and dictating. We find it is absolutely necessary, no matter how we may analyse the soil, to get back to that point, because the ground after all, or the soil, may contain any amount of potash or phosphoric acid, but the question is, is that in a form which is available to the plant, and we find as a result of these experiments that have been cited that in some cases they were not available. For instance, we found results here in one case of potash getting results where it did not give results in other places, and most likely the potash there was held in some form of combination that prevented it being taken up by the plant, and so with the others. So it is not the amount but the availability, and I firmly believe this, with all our learning, the controlling of the humus and the controlling of the lime contents of the soil are the two great controlling factors in the soil. If you have got plenty of humus in the soil to help conserve the moisture, as a result you get plenty of that material decaying, and you get the acids which are essential to bring the potash and the phosphoric acid into solution. Without these all you have got in the soil under natural conditions will be no use. It is only as we can get the acids that are formed from the decaying organic matter that we get the use of that acid in the soil, and, therefore, the humus must be the controlling factor. Then again the lime, all the reactions that are continually taking place in the soil are more or less influenced by the quantity of lime in that soil, and you will usually find a soil rich in lime an active soil and a good productive soil, while a soil poor in lime is a poor soil. It is just like everything else, it may be overdone in the amount that is applied to any particular soil.

Q.—What is that old lake bottom along the south side of Lake Ontario?

PROF. HARCOURT: I really do not know. We are in that position that we know comparatively little about the characteristics of the composition of the soil in various parts of this Province, but we have under way now some work, or, rather, we are asked to formulate plans whereby we will not be in that position very much longer.

Now, as a result of experiments, or experiments planned, I may say we have a number of orchards in different parts of the country to-day on which we are working. Our plots are all five plot experiments, or six if you like, with a check plot at either side of the experiment with a complete mixture, and then with one of each of these three substances dropped out, making four plots that are fertilized.

We have a number of these throughout the country. This is the second year, and many of these results are not in yet, so that I am not in a position to give you figures; but one peculiar thing I want to speak of in this connection is the point that has already been brought out—the value of nitrogen in apple production. We have an orchard under experiment to which farmyard manure has been applied regularly for some years, and the question came to me, "Why cannot I get better fruit from this orchard?" It was having naturally a tremendous growth of wood with an immature crop at the end of the season and a crop without color. On that ground we applied no nitrogen, but we applied potash and phosphoric acid on one plot, and we left out the potash on another. There were twenty-four bushels on an equal number of trees that had received none of the fertilizer. Where we put in both potash and phosphoric acid we got seventy-five bushels, and on the plots where we left out the potash it dropped to forty-eight bushels. You can see there was quite a difference, and just emphasizes again the point that every man needs to experiment in his own orchard to get the results, and while we need to pay attention to nitrogen, while we want a good supply of nitrogen, it, like many other things, can be overdone and you can get too much of it. One other point I would like to make is just this, that it seems to me under our present conditions I would not like the fruit growers to drop their cover crop when they put in an experiment of this kind. If you put any such experiment in your orchard put it in addition to the best cultivation and the best cultural methods you can in your orchard. Do not apply nitrogen expecting it to take the place of the nutrition that you hope to get out of your cover crops, but keep your cover crops to get all the benefit you can from them and apply this other in addition to them so as to bring out your results. There are a number of other points which might be taken up but as the hour is late I think we had better leave it out.

INVESTIGATION WORK ON PEACH YELLOWS AND LITTLE PEACH.

L. Caesar, Provincial Entomologist, Guelph.

As most of the peach-growers probably know, I spent almost all this summer in the Niagara district in order that I might have a better opportunity to study Little Peach and Yellows and carry on investigation work on these diseases. As many growers no doubt would like to hear what line these investigations took and what results have been obtained, I have prepared the following account of my work.

In studying diseases one naturally tries to discover the cause, but I have not attempted to do so, because I know that if one were to endeavor to find this in the case of either Little Peach or Yellows it would almost certainly mean years of the most careful laboratory and field work with the probability of ultimate failure; for many good students of plant diseases have endeavored to find the cause of Peach Yellows and failed. Moreover, I had learned in the autumn of 1911 that Dr. Duggar, formerly of Cornell University, but now of the Botanical Gardens, St. Louis, was working on these diseases, and he thought he had at last found a clue that might lead to the discovery of the cause. (For the sake of those who think that a powerful microscope would reveal the presence of some very minute causal organism, I may state here that no microscope shows any organism to be present, nor can any organism as yet be got to grow in any culture. So that, whatever the cause is, it is very different from that which produces Pear Blight or any of our other

common diseases.) Feeling, therefore, that the study of the cause should be left to others better qualified for that work, I have devoted my attention to discovering, if possible, in what way or ways the diseases are spread, and at what time or times of the year this takes place, and also how long a period may elapse from the inoculation of a tree until it shows clear symptoms of disease. If we get definite knowledge on these points we can then hope to simplify and improve our methods of control, whether the cause is discovered or not, though we sincerely hope it will be.

In determining how the diseases are spread I have thought of the following: (1) Pits from diseased trees, (2) buds from diseased trees, (3) bees carrying pollen or nectar from diseased to healthy blossoms, (4) rubbing or injuring healthy trees with diseased ones when removing the latter from the orchard or in any other manner, (5) pruning tools used on diseased and then on healthy trees. Experiments have been planned and carried out to test all of these possible methods of spreading Yellows and Little Peach.

Pits. In the autumn of 1911, with the assistance of Mr. Nelson, of Fonthill, and Mr. Harkness, of the Experimental Station, 631 pits from diseased trees were gathered. Mr. Harkness planted 331 of these at the Experimental Farm; six germinated and grew. Mr. Nelson planted 200 at Fonthill; eight germinated and grew. I planted 100 at Guelph; seven germinated and grew, thus making a total of 21 diseased pits in all that grew, or about 3 1-3 per cent. Of the healthy pits used as checks Mr. Harkness got 20½ per cent., Mr. Nelson 45½ per cent., and I got 68 per cent. to grow. The seedlings from the diseased pits, though not quite so vigorous on the average as those from healthy ones, show no sign yet of disease, but will be kept for several years to see whether it develops.

Believing that a further test of pits should be made, I have with the aid of Mr. W. E. Biggar, the provincial inspector, and Mr. Spencer, of the O. A. C., Guelph, gathered a few more than 2,500 pits this fall from trees selected by myself in each case. A few of these trees showed symptoms of disease very distinctly, most of them only moderately so, and one tree from which 400 pits were taken would have escaped the notice of nine out of ten inspectors. The pits were gathered in October, and to make sure that there could be no mistake the fruit in every case was collected directly from the trees. The 400 pits mentioned above are being kept separate to see if any larger percentage of them will grow than of those gathered from trees showing the symptoms fairly clearly.

Buds. Several experiments have proven that Yellows and Little Peach can be spread by using buds from diseased trees, but I thought that we should test this ourselves and see not only how long it would be before the seedlings or trees thus budded would develop the symptoms, but also what variation there would be in the length of this time. Accordingly, ten healthy trees four years old in a young orchard on the Experimental Farm were budded. The buds in each case were taken from healthy looking shoots on diseased trees, about half of them from Yellows and half of them from Little Peach. Each tree had at least four buds inserted into it, all of which took. Each budded branch has been tagged so that track can be kept of it. In addition 100 seedlings from healthy pits were budded in a similar manner so that we might be able to compare the result on these with that on the older trees. Nearly all of the buds on these seedlings also took. The budding was for the most part done by Mr. J. W. Smith's best budder, whose services Mr. Smith very kindly offered to me.

Bees or Other Bloom-frequenting Insects.

To test whether insects could carry the disease at the blooming season nearly 200 blossoms were pollenized in the same careful manner that hybridists use when trying to produce new varieties of fruit. Pollen from four trees that I knew had been diseased the previous year was used on each tree. The 200 blossoms were distributed over nine trees. Of the blossoms thus hybridized 80 per cent. set fruit which remained on at least as long as the so-called June drop. A large proportion then dropped off but some remained and reached maturity. None of these trees have this season shown any signs of disease.

In addition to the hybridizing the blossoms on two other trees had nectar from diseased blossoms added to them. These trees also are still looking healthy.

Rubbing or Injuring Healthy Trees with Diseased.

On August 13th four trees four years old were inoculated by rubbing several branches on each with diseased branches until the bark was ruptured. Again, on September 9th, five more trees of equal age were inoculated in the same manner. On July 31 leaves and fruit from diseased trees were gathered and crushed and a little water added to them. The juice thus formed was filtered carefully and three holes were made with a brace and a small bit in each of four trees. The filtered juice was then poured into each of these and the hole covered over with grafting wax. This experiment was intended as a supplement to the rubbing, because, if in both cases the trees thus treated were to contract the disease, it would show that at least the sap contained the source of contagion, whereas the rubbing alone would not make this so clear. No sign of disease has yet been seen on any of these trees.

Pruning Implement: On May 3rd three trees were inoculated with a saw. In doing so branches were cut from diseased trees and brought to the healthy ones, then a fresh cut was made in each of these and immediately after on several branches on the healthy trees. The cuts were made chiefly on the underside to prevent drying out rapidly. At this date the buds were swelling but none of the blossoms had burst. On July 4th four more trees were inoculated with the saw in a similar way. The trees are all still healthy.

Careful records have been kept of all the trees treated in the above various ways, and the results will be watched with much interest next season. I was not surprised that no positive results were obtained this year, as I did not expect any from what I had learned of the disease from observations and reading. Interesting results from some of these experiments may be expected next year if the disease works in the same way here as in some of the states across the line.

The second main subject of investigation was to determine when the diseases were spread. Fortunately the above experiments, intended primarily to show how the disease is spread, are equally well adapted to show when this takes place. For instance, if the trees on which the blossoms are hybridized with pollen from diseased trees develop the disease in a year or two and the untreated trees all around remain healthy we can feel pretty certain not only that bees can distribute the disease but also that it spreads at least in blooming time. Again, if trees pruned before the buds burst with an inoculated saw do not develop the disease and those pruned a month or so later do develop it we shall have some more data of value.

Our third subject of investigation was to determine how long a period elapses from the time a tree is inoculated until it shows the symptomes of the disease, and what variation there is in the length of this period. This, I believe, is a very im-

portant matter, but fortunately once more nearly all the above experiments will help to give us data on it.

As these experiments begin to give definite result they will prepare the way for further investigations until finally we have succeeded in getting together a mass of reliable information that we hope will be of much service in the control of these dreaded diseases.

In order to eliminate the danger of the trees that are being experimented on contracting disease from other trees of the district, I am arranging to carry on a series of experiments in Norfolk County in a section several miles from where any peach trees are now growing.

Moreover, as the degree to which the nurseries spread the disease is very important, I am planning next year with the co-operation of Mr. Biggar and the other inspectors to accumulate data on this point.

Whatever time I had left after performing the experiments this year was largely devoted to studying more closely the various symptoms of the diseases, helping the inspectors to recognize them and holding demonstration meetings in various sections. These meetings were well attended.

On my invitation, Dr. Duggar, who, as I have mentioned, is investigating the cause of Yellows and Little Peach, visited the district and spent nearly three days with Mr. Biggar and myself studying the various symptoms and other points of interest connected with these diseases in different parts of the Niagara district. I have heard from Dr. Duggar since his return home, and he says he feels more confident than before of ultimately getting to the root of the trouble. During the visit he suggested a few ways of investigation that I hope to take up next year.

In conclusion, I may say that Mr. McCubbin, of the Botanical Department of Ottawa, has started to study these diseases, and I look for much help next year from his co-operation.

Investigations, however, will not cure these diseases, and I cannot urge too strongly upon peach-growers the necessity of destroying promptly every diseased tree in their orchards, whether marked by an inspector or not. I regret to say that while this is being done conscientiously in some districts, in others the growers, even some of the leading men, are very careless and indifferent and doing little or nothing towards encouraging thorough work in their districts.

MR. ARMSTRONG: Where are those specimens?

MR. CAESAR: There are ten in Jordan Harbor experimental station out against the lake. No disease has shown up at all in that orchard yet. They have about forty seedlings, thirty-eight back in some part of that farm, sixty rods away from any peach orchard, that are budded. Then sixty seedlings at Guelph are budded.

Now, around St. Catharines I am told that the Inspector is not backed up in his work. You men at St. Catharines had some 2,300 trees marked last year, and you have some bad orchards, although you have not had it as bad as Grimsby. The St. Catharines territory has not been covered. You are trying to do far more with one inspector than you can do. In the Grimsby district he has been over it twice or three times. From Jordan Harbor right up as far as Winona every tree is going out, just as it should, but in some of the other districts the trees are not being taken out as they should. Two things are possible. One is to let the men suffer if they are not going to look after them; but that is not fair to the man who is trying to do his best when his neighbour is not trying. The other thing is that the inspector should be ever so much more strict, and every man

rise to a higher sense of his duty in this regard. When an inspector comes around and marks a tree in your orchard, and you do not believe it is diseased, you have the right to appeal to Mr. Biggar and myself, and when we come to an orchard and say a tree is diseased, and you say it is not, you in your limited experience are saying you know more about this disease than we do, and we have been working at it for years. Now, we do not want to be put in the position of forcing you, but there is nothing else for it. I do not know of a single case where Mr. Biggar and myself have decided a tree was diseased that it has turned out wrong. I would like to say to the men in the districts which are too big for one inspector, appoint another inspector. I have heard in some districts there is a movement to hamper the inspectors. Now, do not allow that to go on. I am speaking plainly, and I recognize many men will feel rather hurt in a way, but I do not mean it in that way at all. What I do mean is this, that in your great hurry with your big crops you have neglected what, if you really stopped and thought carefully over it, you would not have neglected.

MR. ONSLOW: Is it not the fact that St. Catharines district is largely composed of other things besides fruit? Grimsby is largely a fruit district. In reference to that remark about Niagara, whose fault is it that this work was not encouraged? Was it the fault of the inspectors or the Townships Councils, or was it equally the fault of the Department in not enforcing it?

MR. CAESAR: I might say, Mr. Onslow, Mr. Biggar and myself said to every Inspector, if you find a man will not take out his trees do not go right at it to enforce it yourself, but send word to us and we will see that that man takes out his trees, and we would be equally fair to one man as to another, we don't care who they are. There have been cases where for experimental purposes trees have been allowed to go in.

MR. ONSLOW: Whose fault is it that those trees have not been gone over three times?

MR. CAESAR: The inspector could not get over them. Take Mr. Pays, for instance. There were a lot of diseased trees there. I called at that orchard nearly two months later, and there were one-third more not marked because the inspector had not been able to get there.

MR. ONSLOW: Can you offer any suggestion by which one Inspector could do better work? Why cannot your Department put on more inspectors?

MR. CAESAR: I hope to visit the Councils when they are appointing inspectors.

MR. ONSLOW: If it is the fault of the Council why is it not the duty of the Department to see that more Inspectors are appointed, or that certain inspectors devote their whole time instead of half their time?

Q.—With regard to inspecting the budding and the pits, is that carried on consecutively? It seems to me the seasons, probably, have a great deal to do with the period of incubation of these things, and perhaps a good deal is due to the unfavorable season.

MR. CAESAR: I hope to duplicate wherever it is feasible every one of these experiments. I am duplicating on pits. Three and third per cent. of the pits are diseased stock. That is much more than in the American reports we have got to grow. We have got at least three times as many to grow as any other investigator I know of.

INSPECTION WORK ON PEACH DISEASES.

W. E. Biggar, Winona.

I will deal briefly with this subject of Inspection of Diseases in Peaches. I consider the two diseases, Yellows and Little Peach the most difficult problem the fruit grower has to deal with in the Niagara district, or any peach growing district. It is a serious question, because where a tree becomes affected with the disease there is no remedy except to destroy the tree. Throughout the district there has been quite a lot of disease during this past year. The inspectors have had, I believe, the most difficult work before them this year that I have ever experienced as an inspector, on account of the conditions which existed, such as winter injury from the severe winter. It was at the beginning of the season by inspection very difficult to be certain whether a tree was diseased or whether it was affected with the severity of the winter. However, with the aid of Mr. Caesar, we finally worked that out, so that I think the local inspectors made but very few mistakes with regard to the disease. I think their work was very accurate, taking it all the way through. Now, as to the inspectors, I think they are doing good loyal work. Of course I know the inspectors get a good deal of criticism, sometimes I think very unjustly. People will say, "Well, here is such and such a man's orchard; it looks almost all of it diseased." And when you come to examine that orchard carefully you will find there is some other cause for the sickly appearance of the orchard. It is not always diseased, but that does not let the inspector out; he gets the criticism that he passed that orchard by and left diseased trees. However, I think, taking it on the whole, the inspectors are doing their work well, as far as I know about it. Through the district, of course, there are sections where I think there is more negligence on the part of the owners of the orchard than there is in other sections, and that is usually where we find the most disease. I cannot impress upon the fruit growers too strongly the necessity of being prompt to remove the diseased trees from the orchard. Even supposing when a tree gets sickly that it is not diseased is it of any value afterwards? If it is weakly and sickly, though it may not be diseased, of what value is that tree to any man? I do not consider it is worth very much, and why the owners of orchards will be so negligent about removing them I cannot understand. Of course they are not all that way. A good many are very prompt, but there are some who are kind of careless, I think, and should look after this work more promptly than they do.

Now, as to controlling the disease it seems to me there are only two methods by which we can ever hope to keep it under control. One is by thorough inspection by inspectors who are thoroughly qualified to do the work and who can go into an orchard and identify each and every sympton that shows it is a diseased tree. This past season we have had perhaps the best assistance we ever had since we have been working as inspectors. Mr. Caesar has been there with us, and I assure you there has been a wonderful improvement in the work of the local inspectors since he came there, and has been assisting them. Originally the inspectors were allowed, as it were, to educate themselves. There was no person to go to them and give them much assistance; but now I think we have a very competent staff of inspectors, and we hope soon to have this disease more under control than in the past. I do not know whether Mr. Caesar mentioned anything to you about the number of diseased trees. I have not a full return yet of the number of trees that we found affected. I have for seven townships, and

in those seven townships there were 15,200 trees marked as diseased trees, and I believe when the full returns are in, it will amount to somewhere near about 25,000 trees. That is about half what it was last year.

I do not know that I can say very much more about the inspection of Yellows. I visited nearly all the nurseries, in fact I think all of them, throughout the Niagara district, and I know there was something said here the other day that would lead people to believe that the nurserymen were careless in fumigating and looking after their stock. I did not visit one nurseryman in this district but who said to me, "I want you to examine our fumigators and our nurseries as well as you can, and see that everything is right; and if there is anything wrong we want to know it." Now, that does not look to me as though the nurserymen were trying to conceal anything. I believe the nurserymen as a rule are doing what they can to put out good clean stock. They have said to me that they like to have me watch the orchards surrounding the nurseries, and if there is anything wrong there we want you to look after them, and I have done so in some instances. I have found there was scale coming into nurseries from adjoining orchards nearby, and these were promptly looked after and they were made to destroy the trees or treat them.

I would like to say a word or two as to the appointment and pay of the local inspectors. It seems to me that it is not entirely satisfactory as it is done at the present time. They are nominated by the municipality, and their nomination sanctioned by the Department, and their pay is regulated by the municipality. Well, some of the local inspectors get $2 a day, some $2.50, some $3 and some $4. I do not know why there should be this difference in their wages if one man is as good as another and doing just as good work. Inspectors do not like to work for $2 a day when men who are mixing mortar and laying brick are getting $4 and $5. They do not relish that very much, and I think there should be some alteration made in the manner of their appointment. I believe it would be in the interest of the fruit growers if the Provincial Government would take over the appointment of the inspectors and pay them. I believe it would be more satisfactory and more business-like if it were done that way, and in addition to that I think it would be better if the inspectors were appointed to some district outside their own neighbourhood. There is a local influence in districts usually where inspectors are working. They have neighbors with whom they have always been good friends, and some of those neighbors are a little negligent and slow about removing the diseased trees, and the inspector does not like to stir up hard feelings. For that reason I believe if the Department would take over the appointmentment of the inspectors the work would be carried on better than it is. However, this is a matter for discussion perhaps, when you have thought the matter over. I know of one instance in a district where one inspector is paid $15 a year for his work. If he did the work that is necessary to be done he would get about 25 cents a day. Now, I do not think we can expect very good results when the work is carried on in that way.

Q.—A moment ago you mentioned there were two methods of controlling these diseases, and you referred to thorough inspection. What is the second?

Mr. Biggar: The prompt removal of the infected trees by the owners of the orchards as soon as they are marked. I could cite dozens of instances where affected orchards have been neglected and the trees allowed to stand. I would like to mention just one instance. About four years ago, before we had any regulations from the inspectors in authority to do anything with regard to Little Peach, I

found an orchard in our district about three-quarters of a mile west of Fruitland, and all I could do was to notify the man that he had disease in his orchard. Of course I could not compel him to remove the trees. There was nothing then in the regulations that gave me any authority to do so. Well, he did not remove that orchard. He left it standing there, and I think it was two years after that before we got authority to do anything with regard to that disease. At the present time I believe there are only two orchards left standing within a mile and three-quarters east and northeast from that orchard I first mentioned, that are still alive. Every peach orchard within a mile and three-quarters of that distance is gone. The whole entire orchard was destroyed with the disease; and that is one very good proof I think that it is a dangerous thing to leave diseased trees in the orchard once you know they are there.

J. B. Fairbairn, Beamsville.

The disease problem that we have heard of this morning is undoubtedly one of the chief factors with which we must all come in contact at the present time. A problem such as this affects the agricultural interests of the community or the locality to a great extent. Our success in growing crops depends very largely on the success we have in overcoming such pests, and to this I would add the willingness of the grower to adopt such practices, or adopt proper practices, to thoroughly and strictly carry out the proper recommendations.

Now, we require inspection of fruit trees for various reasons, but chiefly on account of Little Peach and Yellows. The symptoms are most easily identified during the months of August and September. These are the two months during the entire season when it is easiest to identify it. Very few men, if they are competent, can find sufficient time over ten days or two weeks, as the case may be, to go through their orchards carefully to examine every tree for disease. I know you would say immediately, why, we are working in our orchards every day and we ought to be able to identify a diseased tree. Well, that is true to a certain extent, and yet my honest opinion is that a man who is working day after day in his own orchard becomes so accustomed to the appearance of his own trees that he does not readily detect any abnormal occurrence. The time to detect the disease is in its very earliest stages, and I believe a stranger coming into an orchard will detect far more quickly the early symptoms of the disease than will the owner himself, even though he may be very competent.

On the other hand I believe that too few of our men are really competent to determine the disease in all its forms, particularly in the early stages. My experience has been where we can point out the disease on the fruit or by the fruit we have not any difficulty whatever in convincing that man that his trees must go. I must say it is only very occasionally in our district where we have had the slightest trouble in convincing a man of the identification of both. I have in mind a man in my own district whom I consider knows the disease in all its forms, a man who is a very progressive fruit grower. He is a man who is working on a small acreage but who spends, I was going to say, night and day in his orchard. At any rate he spends all day and part of the night, and I was quite sure when I visited that man's orchard I would not find any disease, because I knew he was very keen to have all trees which were diseased removed immediately. Yet I was very much surprised, indeed, to go in there and mark out of a small number of peach trees ten diseased trees, and those ten trees I may say showed the disease very markedly.

It was not exactly in its early stages. That I think bears out what I have said in regard to a man becoming familiar with the appearance of his trees in his own orchard.

Further than that, the symptoms differ very greatly in different orchards. The symptoms differ perhaps because of different treatment or different cultivation, or because of cropping between the trees, or because of a worn-out condition of the soil. There are very many reasons which affect the disease and consequently affect the symptoms, and while a man might see that his trees were sick he might not feel sufficiently confident to cut them down. These are some of the reasons, as I have said, why we should have inspection.

Then in addition to inspection we must have co-operation on the part of the grower, and I am very much surprised to hear some of the remarks made by Mr. Caesar this morning, and also to get an intimation not very long ago from a certain source that there were districts in which inspectors did not receive the backing that they should receive at the hands of the grower. I honestly say that it came to me as a surprise, because I had not anything but the very best to say about the reception I received at the hands of the growers in my district this year. I was met with the utmost grace. If I may say so, I was met at the gate with an open hand by the growers in every instance. I cannot recall one single instance, and I covered every farm in the township but one—at least every farm in the east part of the township and a good many in the west part—where I was not treated in a very kindly manner, and in the majority of instances they took time to go with us through the orchard. It was a busy time yet in nine cases out of ten the grower took the time to go with us, and stayed with us until we were finished. I suppose they were glad to see the last of us, but at the same time they did not show it.

As an instance of this I would like to say that one man in the district as soon as he knew I was there called his two men and told them to bring the team and the axe. He said, "We are going to spend the day going through the orchard, and we are not going to leave a tree ten minutes after it is marked," and I think when I went out of the orchard at night every tree that I had marked was down and taken out, and it was quite a number.

Another man who had a large orchard of some four or five thousand trees was going away that afternoon and I told him not to bother going with me, that I would get through all right, and leave word with his man as to the trees that were marked and so on. "No," he said, "I am going to go with you." He said, "Time is money with me, but I consider if I can learn anything that will help me to identify the disease in my orchard it is time well spent if I spend the entire day." I cite these two instances to let you know the attitude of the growers in our section; and while ours is a young and growing section, and while there are in the district about 55,000 trees only five hundred trees were marked that year, just about one per cent. of diseased trees. I feel that we have a pretty good report to bring to the meeting. I want to say we are going to try to live up to that. We feel we can keep the disease to its present limits. Of course it is not only the work of the inspector to do this, but the work of the farmers of the community as well. We know what ravages the disease will make if allowed to spread, and I believe every one is anxious to keep it down the very best they can.

I see my time is up, but I would like to say just one word if I may with regard to the appointment of additional inspectors. I came here prepared to give more time to that than anything else, but as Mr. Caesar spoke about it I do not need to

say so much. My own opinion is that twice the number of inspectors would do far more efficient work. Two inspectors working together would have much greater assurance in marking trees. They would cover the ground I think even faster than each man working alone, because I assure you when you get into an orchard of six, seven, or sometimes twelve thousand trees on a hot day in August, and walk up and down those rows looking at tree after tree it gets rather monotonous, and if there are two working together they can cover that orchard in just half the time, and they may now and again meet at the end of the row and look at each other and have a word together, and the work would go along with a great deal more vim.

At the present time the inspection is chiefly confined to peach trees, and I do not think in my own district that a large number of the farmers are receiving the benefit from the inspection that they ought to receive. We cover the territory only once, and we should cover it twice or perhaps three times. There are certain farms I have visited three times, of course. Those were cases where the men were sufficiently anxious about their trees to keep telephoning me day after day and day after day, until they got me to come at the expense of my own work, to go over their orchard the second or third time. There are certain places where I have done that, but with the additional men you could do that with every place. Aside from that there are apple orchards and cherry and plum orchards. Now, in our particular section south of the main road, or the stone road, there is a large portion of the township, I may say, uncovered. I have never visited a farm, and I doubt if the inspector before me ever visited a farm. Now, those men who are raising apples and pears with a certain amount of plums and cherries, ought to receive some consideration or some help at least from the inspection, so far as San José scale or black knot, and so on, are concerned. I feel that these men are entitled to some recognition, and the only way it seems to me they can get it is by the appointment of additional inspectors.

Q.—I would like to ask Mr. Caesar a question as to mottled leaf. You were somewhat undecided in your mind about that?

Mr. Caesar: We have decided that mottled leaf unless it has the other symptoms of Yellows and Little Peach is not a sign of those diseases.

Q.—What is that mottled leaf caused by, or what is it a symptom of?

Mr. Caesar: I asked Dr. Tucker his opinion about that, and he is not sure. It is caused in some cases by excessive moisture in the soil. In many cases it is clearly associated with that. Perhaps Prof. Stewart can give a reason for mottled leaf which is often very bad on Japanese plums, European plums and on peaches.

Prof. Stewart: No, I have had no experience; and anything I might say would only be a guess.

Mr. Caesar: I would like to say one word. I do not want you to get the idea that the St. Catharines district has more Little Peach and Yellows than any other district. They have some beautiful orchards there. I just want to waken the people up there so as not to let it get a good start. The percentage I got was a very small one, and I am trying to save them from ever getting a real bad attack. They must see the necessity of taking vigorous measures, and the same thing applies, as I have said, to Niagara-on-the-Lake, and over at Fonthill. Fonthill had a very bad attack, but Fonthill is very wide awake to-day. They were badly burned at one time, and a child who is burned fears the fire afterwards.

Q.—Speaking of Fonthill our inspectors were taken away from there to pack

peaches. I would like to know how they can do the inspecting when they are taken away to do other work?

MR. CAESAR: Mr. Arnold was one taken away, but he is not a Peach Yellows Inspector. Mr. Nelson found only about eighty trees in his district, so you see it does not apply to the inspectors who are on Yellows and Little Peach to any extent.

There is another thing about the disease this year. The very wet season made it impossible day after day for inspectors to go through the orchards, and therefore the work has not been done as we would like to have it done. That made it very slow. I know Mr. Fairbairn and Mr. Reid spent day after day hoping they would be able to get out. They could have got over it in half the time. In every district we have to have two inspections, or we are not going to control this disease. An inspection in August, when most of the inspecting is done, does not get much more than half the trees. The last inspection should be late in September, and if the season is good right into the first week in October. After that it is not safe to do it.

Q.—Do you find the disease develops much after the peach is ripe?

MR. CAESAR: Yes. Take for example the orchard I referred to a little while ago at Niagara-on-the-Lake. The fruit was beginning to ripen then, and at that time almost all the trees are marked. There had been a few trees missed, and I visited there nearly two months later and I could have marked one third more trees. Supposing there were one hundred marked I could have marked thirty-three more or probably fifty more.

Q.—Do you find the disease on later ripening varieties after the fruit ripens?

MR. CAESAR: So far as I can pass an opinion now, I should say it will develop on any tree so that you can see it if it is almost showing up at the time of the fruit ripening. You see it takes a certain length of time to grow, and if it is nearly appearing at the time the fruit is ripening then it will show up at the end of that fall. It will become more apparent as the season goes on.

MR. ANDREWS: I would like to say a word with regard to the appointment of inspectors. I think it very desirable that the Department think that matter over. In our township it was postponed to the second meeting, and I was hoping the Department might take the matter up. It might very easily happen, and I expect does happen in many townships that the Council is elected from the agricultural districts which are not entirely fruit districts, and there is no interest amongst the Council regarding this work. Therefore, I think it would be very desirable, if it could be done, to take it out of the municipal council's hands. I do not say there is anything like this in our Council, but still it might easily happen in a township.

MR. ROBERTS: Might I suggest that that matter be left with the Niagara Peninsula Fruit Growers' Association? I believe the first suggestion was that the appointment should be made by the Government, but it was altered. Now, I think as the peach growing is all in the territory of that Association it would be a wise thing for the Niagara Peninsula Association to deal with it rather than this Association.

MR. CAESAR: Before you ask the inspectors to be appointed by the Province you will have to agree among yourselves what you want. It must be unanimous or almost unanimous on the part of the fruit growers before the Government will move in the matter. I feel satisfied of that.

THE CHAIRMAN: There is a resolution in the hands of the Resolutions Committee, which they have passed upon favorably, referring to that very point, and it will come up a little later.

INFLUENCE OF CULTURAL METHODS AND COVER CROPS, ALONE AND WITH FERTILIZATION, UPON THE YIELD, GROWTH AND COMMERCIAL QUALITY OF APPLES.

Dr. J. P. Stewart, Experimental, Pomologist, State College, Pa.

At the outset it may be well to call attention to the fact that the relative value of the various cultural methods used in orchards is not dependent upon anyone's opinion. It is not a matter of sentiment, nor can it be settled by vote. It cannot even be settled generally by the results of any single experiment or group of experiments, although they should be very valuable. It can be settled with certainty, for any given orchard, only by asking the trees. Whether this is done by the investigator or by the orchardist himself, however, the question must be put perfectly fairly, with neither prejudice nor preference, and with the sole idea of getting the actual answer of the trees, and stating it wholly impartially and without the slightest personal interest in the outcome.

This is the attitude that we have undertaken to maintain in all our experimental work, and especially in the experiments with cultural methods and cover crops. Moreover, the present report is to be considered only as a report of progress and not as a statement of final conclusions. The writer is free to confess that some of the present results are different from what was anticipated, and hence is reserving judgment on them until further results are secured. But our anticipations are not necessarily correct, and the present indications may not be changed. Hence our present results are given just as they stand, with such comments and cautions as now seem pertinent to the writer.

In the discussion following, it will be observed that our present results are derived from nine experiments, located in different parts of the state on seven different types of soil, and involving 1,991 trees, 588 of which (in experiments 331, 333 and 337) were planted in connection with these experiments. Four of the experiments—numbers 217, 218, 219 and 221—were started in 1907, and the remainder in 1908. The growth data are obtained from annual measurements of all the trees at definite points on the trunks, and the data on yields are secured from the annual production of fruit, which is studied from three view-points—those of yield, color and average size. The total amount of fruit thus examined, during the past five years, is 1,149,702 pounds, or about 23,000 bushels. The locations, soils, present ages of trees, and other general features of our cultural-method experiments are shown in Table I.

TABLE I.—LOCATION AND OTHER DATA ON ORCHARD CULTURE EXPERIMENTS, CONDUCTED BY THE PENNSYLVANIA STATE COLLEGE.*

Experiment. No.	County	Soil Types.	Varieties.	Age 1913	No of Trees.	No. of Treatments.
217.....	Franklin ...	Montalto loam	York, Imp. and Gano..	20 yrs.	358	12
218.....	Franklin ...	Hagerstown clay loam..	York and Albermarle.	14 & 21	400	12
219.....	Bedford	Frankstown stony loam	York, Jonathan B. Davis and Gano	10 to 12	320	12
221.....	Wyoming....	Chenango fine sandy loam	Baldwin and Spy.....	40	115	6
331.....	Centre.....	Hagerstown silt loam..	Baldwin, Stayman and York	5	288	8
333†....	Centre.....	Hagerstown silt loam..	Baldwin, Stayman and York	5	120	12
336.....	Chester	Chester loam.....	Smokehouse and Stayman	10	105	3
337.....	Mercer	Volusia silt loam	Baldwin, Spy & Rome	5	180	4
338.....	Lawrence...	Volusia silt loam	Baldwin	24	105	3
Totals..	7	7	10	.....	1,991	.....

*The addresses of the owners of the orchards in which these experiments are located are as follows: 217, J. H. Ledy, E. Fayetteville; 218, Ed. Nicodemus, Waynesboro; 219, Jos. R. Sleek, New Paris; 221, F. H. Fassett, Meshoppen; 331 and 333, Department of Experimental Pomology, State College; 336, A. D. Strode, Westchester; 337, Rev. A. M. Keifer, Greenville; 338, J. B. Johnston, New Wilmington.

†Experiment 333 is devoted entirely to a comparison of cover crops, with special reference to their effect on the trees.

GENERAL PLAN OF THESE EXPERIMENTS.

The general plan of our cultural-method experiments is shown in Figure I. Its main purpose is to determine what combinations of culture and fertilization give the best results under the different conditions involved, and eventually to determine why these results are obtained. The plan is followed in full in the first three experiments of Table I., with only minor deviations in such matters as numbers of trees and relative positions of the plots. In the other experiments, for various reasons, certain of the treatments have been omitted, and in the young orchards of experiments 331 and 337, single plots involving intercrops have been added. In experiment 333, the entire attention is given to a comparison of cover crops, one of which is a permanent cover and has received tillage only at the beginning of the experiment. The essential features of these modifications can be seen in the treatments listed for the different experiments in the tables that follow:

I. Clean tillage. 40 trees.	IV. Tillage and cover crop. 40 trees.	VII. Sod-mulch. 40 trees.	X. Sod. 40 trees.
II. Tillage and mauure. 20 trees.	V. Tillage, cover-crop and manure. 20 trees.	VIII. Sod-mulch and manure. 20 trees.	XI. Sod and manure. 20 trees.
III. Tillage and commercial fertilizer. 20 trees.	VI. Tillage, cover-crop and commercial fertilizer. 20 trees.	IX. Sod-mulch and commercil fertilizer. 20 trees.	XII. Sod and commercial fertilizer. 20 trees.

Fig. I.—Plan of Pennsylvania Orchard Experiments on Cultural Methods, Cover-crops, and Manures.

As indicated in Figure I. and Table I., our complete experiment on cultural methods compares the four principal methods of managing orchard soils and it is duplicated, wholly or in part, in several localities on a wide range of soils. Each method occurs without fertilization and also with it in two forms, both applied annually. The stable manure is added at the rate of 12 tons per acre, although 8 to 10 tons would probably be ample. The commercial fertilizer carries all three of the elements usually considered important, at the rates of 30 pounds of actual nitrogen, 60 pounds of "phosphoric acid" (P_2O_5), and 100 pounds of "potash" (K_2O) per acre. About half of the nitrogen is carried in nitrate of soda and the other half in dried blood, requiring about 100 pounds of the former and 150 pounds of the latter. The phosphorus is carried in acid phosphate and the potash in the high-grade muriate, containing about 50 per cent. (K_2O).

At present retail prices, such a fertilizer costs about $12.80 per acre. Here, again, our results indicate that a reduction of at least 10 pounds in the phosphoric acid and of 50 to 75 pounds in the potash would usually be equally efficient, and would effect a saving of about $2.60 to $3.65 per acre. In ordinary practice, also, part or all of the nitrogen might be obtained by growing legumes or by the use of manure, although this has not always proved to be really economical. The manure used in our experiments—at $2.50 per ton, which is about as low as it can be obtained and applied—costs nearly 2½ times as much as the fertilizer we are using and its benefits do not average materially better. More actual plant food is also being added in the manure, since the amount applied should carry about 120 pounds of nitrogen, about 80 pounds of P_2O_5, and 110 to 115 of K_2O.

All the tillage plots are plowed early in May and are kept cultivated until about the middle of July, when those receiving the cover crops are seeded to such plants as crimson or medium red clover, and hairy vetch. On the other tillage plots, cultivation is stopped at about the same time as on those receiving covercrops, but no seeding is done and only such vegetation as comes up naturally is obtained.

On the mulch plots, all herbaceous growth remains in the orchard, and it is mowed at least twice during the season. The first cutting is raked to the trees as a mulch, and the second is left where it falls. In the older orchards also, about three tons per acre of outside materials, such as old straw, swamp hay, buckwheat straw, or other vegetation, are brought in annually to form an additional mulch around the trees. In the younger orchards much less outside material is needed, and in some of them a satisfactory mulch has been maintained from the growth between the rows, after one or two initial applications from the outside. Our mulch method, therefore, differs somewhat from the so-called "Hitchings" plan, the difference being primarily in the maintenance of a definite mulch under the trees, with materials brought from outside sources when necessary. As a means of conserving moisture, the definite vegetation mulch is very much superior to the other plan.

Some real protection against mice must be provided in any mulch system. This can be done by screens, poisons, or proper coatings, and especially by maintaining a clear space for about a foot out from the bases of the trees. In ordinary practice, also, the best results with the mulch system can doubtless be obtained by using leguminous plants of relatively low moisture draft, such as hairy vetch, to act as the permanent cover and to furnish at least part of the mulch. Although essentially an annual, this plant frequently lasts fairly well for two or more seasons after a single seeding. This is especially true after the soil gets properly in-

oculated, and where the winters are not too severe. We also know of an orchardist who is apparently maintaining it permanently by giving it a rather thorough discing about mid-summer or after the seeds have been matured in considerable abundance.

Results in Young Orchards.

The effect of wood growth thus far obtained in one of our young orchards at the College is shown in Table II. These trees were planted in the spring of 1908, in a rather depleted soil of limestone origin. In the first five plots, the soil was plowed in the fall of 1907, and prepared about as for corn before planting in the following spring. In the last three plots, no tillage was given either immediately before planting nor since. The trees were simply planted with a spade in the thin, old pasture, and a mulch of about 10 pounds of straw was placed around each tree, together with screen protectors against mice. Since then there have been one or two slight additions to the mulch from outside sources, but in the main it has been maintained satisfactorily by the inter-growth, in the manner indicated above. The average gains made by the trees under these different treatments for the first five years are shown in Table II.:

Table II.—Influence of Cultural Methods on Growth, Young Orchard.

(Average increase in trunk girth, first five years, in Experiment 331.)

Plot.	Treatment.	Average Gain.	Gain over Clean Tillage.	
		Inches.	Inches.	Per cent.
1*	Clean tillage	3.68	.....	.....
2	Tillage, intercrop and cover crop	3.67	—.01	—0.27
4	Tillage and cover-crops	3.61	—.07	—1.90
5	Tillage, cover-crops and manure	4.51	0.83	22.56
6	Tillage, cover-crops and fertilizer	3.92	0.24	6.53
7	Sod-mulch	4.61	0.93	25.27
8	Sod-mulch and manure	4.86	1.18	32.07
9	Sod-mulch and fertilizer	4.85	1.17	31.80

*The numbers of treatments here correspond with those stated in Figure 1, except in the present plot 2. It involves an intercrop, and hence is different from any treatment named in our general plan.

In this table and also in the field, it is very evident that the untilled trees have made the best growth in the present experiment. This may be partly due to the absence of root pruning under the mulch, but the chief benefit thus far seems to be connected with moisture conservation, rather than with the plant food added. This appears in the fact that the only tillage treatment which has shown much improvement in growth is the one in which manure is applied, and even its gain is surpassed by the mulch alone in plot 7. In plot 8, where the manure is added to the mulch thus practically eliminating its moisture-conserving effect, its gain over the mulch alone is only a quarter of an inch on the average, or a gain of about 6½ per cent which may be properly credited to its plant food effect. This plant-food benefit is practically duplicated by the fertilizer applications of plots 6 and 9, the remaining benefit on the latter being apparently due to the mulch.

In plots 1, 2, and 4, there is very little difference—less than a tenth of an inch in the averages. The slight advantage now possessed by the clean tillage alone is again probably connected with its lower demand for moisture as compared with the

cover crop used in plot 4. It is notable however, that the net influence of the cover crops in this case has been to check rather than to benefit the growth of the trees. To the close of the fifth year, therefore, the cover crop has made no visible return for itself, so far as the trees are concerned. It has consisted chiefly in a mixture of red and crimson clover sown about July 10th to 20th, and only the last three covers have been really good. In plot 2, the intercrops have been potatoes, peas, mangel wurzels, and sweet corn, with the fertilization considered best for each. They were kept at a reasonable distance from the trees, and the intervening spaces were cultivated until midsummer, and again when the cover crops were sown, which was after the intercrops were removed and hence was usually rather late. None of the intercrops have proved especially profitable, and neither have they proved any serious detriment to the trees, as compared with the other tillage methods, since their check to tree growth is slightly less than that of the cover crops sown in the midsummer. These results are similar to those obtained by Emerson at the Nebraska Station, and reported to the close of the second year in 1903, in their bulletin 79, pages 14 to 17.

Results in the Mercer County Orchard.

Additional data are available from another experiment started by us in 1908 in Mercer County, the latter portion of which is fairly similar to the experiment just considered. In the present experiment, the treatment of plot 12 corresponds with number 2 in the experiment just considered. The usual tillage and cover crops have been maintained on plots 1 to 12, using rye chiefly as the cover, on account of the lateness of some of the intercrops. Plot 13 has received tillage alone, and 14 has been mulched as in experiment 331, though more often. The results on growth are shown in Table III.:

Table III.—Influence of Fertilization and Cultural Methods on Growth (Young Orchard).

(Average increase in trunk girth, first five years, Experiment 337.)

Plot.	Treatment.	Average Increase.	Gains over Normal Growths.	
		Inches.	Inches.	Per cent.
1	Check (unfertilized)	3.28	.....	.....
2	Nitrogen and phosphates	3.78	.44	13.17
3	Nitrogen and potash	3.51	.11	3.24
4	Check	3.47	.....	.....
5	Phosphate and potash	3.94	.14	3.68
6	Complete fertilizer	4.73	.60	14.53
7	Check	4.47	.....	.....
8	Manure	4.57	.32	7.53
9	Lime	4.61	.58	14.39
10	Check	3.91	.....	.....
11	Tillage and cover-crops	3.88	.28	7.78
12	Tillage and intercrops	3.60	.....	.....
13	Clean tillage	3.72	.13	3.62
14	Sod-mulch	4.32	.72	20.00

Here, again, the trees receiving the mulch are showing decidedly the best growth, though their advantage is not quite so great as in experiment 331. The cover crop in this case is proving slightly better than clean tillage alone, probably because the relative importance of moisture and plant food seems to be reversed here. But the advantage on the covercrop plot is still too small to show any profit. The intercrop here has been vegetables—chiefly potatoes, beans, and peas. They show the lowest tree growth of any of the cultural methods, but their deficiency is very slight, and it is probably chiefly due to their location, which has been somewhat wetter than the others. This has now been corrected by tile drainage.

As already intimated, the conservation of moisture seems to be of less importance than plant food in this orchard. This is not surprising to one familiar with this Volusia soil type and also with local conditions. Even at that, however, the response to fertilization shown in the first ten plots is somewhat greater than we had expected in so young an orchard, and in a similar experiment at the College this response is not duplicated. The latter result is more natural in the case of young trees for several reasons. The particular demands of the trees have been operating for only a short time, most of the food of the leaves is annually returned to the soil, the mineral content of wood is rather low anyhow, and in reality comparatively little of it is being formed in a young orchard. For these reasons we usually do not expect much response to fertilizers in the case of young trees.

The response here is rather irregular, but in general it indicates the value of nitrogen and phosphates, which corresponds with our results on this same soil type in the Johnston orchard, in which older trees and both yields and growths are involved. The chief irregularity here appears in plots 8 and 9, in which manure is showing less effect than we would naturally expect in the light of their behavior elsewhere. This irregularity appears to be much greater in the percentages than in the actual average gains on these two plots, an effect which is brought about by the abnormal strong growth on the check plot 7, possibly due in part to leaching or cross-feeding from plots 6 and 8. Beyond this, however, we can offer no further comments on the present results, and we are awaiting further returns.

Results from Cover Crops at the College.

Similar data, bearing especially on the value of cover crops, are available from another of our experiments at the College. The crops used in this experiment are stated in Table IV.

These crops are plowed under annually and the usual orchard tillage is given on all plots excepting the alfalfa. The latter plot was plowed only at the beginning of the experiment, at which time the soil was limed, manured and inoculated and otherwise prepared as usual for alfalfa. The liming also was extended to the other plots. The initial stand of alfalfa was unsatisfactory, and it was therefore turned under at the beginning of the following season and immediately reseeded to the same crop. Since then nothing has been done with this plot, except to cut the alfalfa two or three times a season and apply as a mulch about the trees. The mulch obtained in this way has been considerably more than was needed to keep down the growth immediately around the trees, and some of it therefore has been hauled away. As the mulched area enlarges, however, this condition will not continue. The relative value of the various crops, as indicated by the growth of the trees, is shown in Table IV.:

TABLE IV.—INFLUENCE OF COVER-CROPS ON TREE GROWTH (YOUNG ORCHARD).

(Average increase in trunk girth, first five years, in Experiment 333.)

Plot	Cover Crop.	Average Increase.	Gain over original size.	Rank.
		Inches	%	
1a	Med. Red Clover	3.82	83.65	12
1b	Mammoth Red Clover	3.73	92.28	11
2a	Alsike	3.78	104.32	9
2b	Crimson	4.34	145.40	3
3	Hairy Vetch	4.42	160.07	2
4a	Cowpeas	3.94	75.11	13
4b	Soy Beans	4.18	101.94	10
5	Oats and Peas	4.28	135.16	7
6	Rye	4.07	133.91	8
7	Millet	4.42	138.92	5
8	Rape	4.27	139.89	4
9	Buckwheat	4.58	137.30	6
19	Alfalfa	5.09	206.63	1

Here, again, it will be noted that the mulched and untilled trees are distinctly superior to the others in their growth. As it is also shown that alfalfa can be safely and satisfactorily used in a young orchard at least, when its growth is prevented by a mulch from competing directly with the tree roots.

For use as a permanent cover and as a basis for a mulch, alfalfa is thus shown to be a very satisfactory plant. Its nitrogen-fixing and its perennial habit are much in its favour, when used as indicated above, but its strong affinity for moisture and also for the nitrogen in the soil would suggest caution in using it in direct competition with tree roots. More work is needed on this point, however, and much more work is needed on the relative values of various plants for permanent orchard covers and mulches, and on the best methods of handling them. Almost nothing has been done along the latter line. Hairy vetch, as noted above, has many of the qualities most needed for this purpose, but definite and comparative data on it thus far as lacking.

Among the annual covers, used along with tillage, the best tree-growth has been made in connection with hairy vetch. This is not surprising, when we remember that it furnishes nitrogen and has a very low demand for moisture—two of the most important requisites for a plant to be associated with trees. The surprising moderation of its moisture draft in comparison with other crops can be seen readily in the furrow slice when these plots are crossed with the plow. We have had cases in which the soil under the rye and alsike plots was practically dust dry, while that under the vetch was turning up almost too wet for plowing. Under these conditions, the clovers were about intermediate in the moisture content of their soils, with the advantage somewhat in favor of the crimson, especially after seed-formation had begun and their vegetative growth had been checked, while the conditions under the frost-killed annuals were more like those under the vetch.

The importance of these differences in moisture can be appreciated when it is remembered that only the moisture of the soil in excess of 8 or 10 per cent. is available to plants. On some of these plots the trees were evidently practically in a state of drought, while those on the vetch plot were almost too well supplied with moisture.

Crimson clover has come next to the vetch in its relation to tree growth. This again is not surprising, but the low position of the mammoth and medium red clovers is wholly unexpected, since they seem to be very much like the crimson clover in their more important characters. It seems quite probable that the growth deficit on the latter plots is due to some unfavorable feature of the soil rather than to the clovers, because their growth has not been very satisfactory until the last two seasons. It is also possible that the greater amount of winter-killing on the crimson plot, which reduces the growth and moisture-loss in the spring may have something to do with its advantage.

In the case of all the other crops, the present effects on the trees are doubtless largely due to their relative effects on the moisture supply, which has already been noted as very important in this orchard, in Experiment 331. The rye influence has not been so bad as might be expected, because it has been sown late—not earlier than the first of September, and it has always been mowed immediately around the trees when it began vigorous growth in the spring. The cowpeas and soy beans, on the other hand are sown some time between June 25th and July 5th. Cultivation is therefore reduced and the crops make a vigorous growth, thus undoubtedly competing rather seriously for moisture and materially checking the fall growth of the trees. The gains in nitrogen and humus from these crops, therefore, have evidently not yet compensated for their reductions in the moisture supply.

The gains with the rape, millet and buckwheat are larger than might be expected, and in the case of the latter cover they may be partly due to a slight advantage in location. Here again, however, our results with this class of crops are not materially different from those of Emerson at the Nebraska Station, which were published in 1903 and 1906 in their bulletins 79 and 92. These crops are all frost-killed annuals, though the rape is much more resistant and usually a few plants will survive the winter. They therefore do not compete for moisture in the spring which seems to be to their credit. Their competition in the fall, also, has not been so serious as that of the other frost-killed crops here.

As winter covers, the millet is the best of these three—chiefly because of its greater ability to hold the snow—and the rape is the poorest. The latter usually withers away and disappears almost completely during the winter. The buckwheat, also, furnishes but little direct protection to the soil, but it does seem to exert a mysteriously good influence on its physical condition, making it looser, mellower, and more congenial to moisture. Its general effect is hardly as good as that of millet, however, and even the latter does not yet impress the writer nearly so favorable for our conditions as the hairy vetch, and possibly the crimson clover. From present indications, however, and with their low cost of seed, either millet, rape, or buckwheat is likely to be much more valuable in many cases, than many of the plants now sown for orchard covers.

Summary for Results in Young Orchards. Looking back over these experiments, we see: (1) that the mulched and untilled apple trees have uniformly made a better growth during the first five years than any of the trees receiving the usual tillage and cover-crops. Similar results are reported from the Ohio Station, in their bulletin 171, page 207.

(2) As compared with clean tillage, followed by weeds or other natural growth, the addition of cover crops has not yet resulted in a material gain. In certain cases, they have even seemed to check the growth of the trees somewhat.

These and the results immediately following are similar to those reported from the Nebraska Station in their bulletins 79 and 92.

(3) The addition of vegetables or other tilled intercrops, accompanied by proper fertilization, has not materially reduced the growth of the trees, as compared with other tillage methods. In one case the resulting growth was slightly better than that of the adjacent trees receiving tillage and midsummer covercrops.

(4) Considerable variation has appeared in the value of covercrops, as measured by their effects on tree growth. Thus far, hairy vetch and crimson clover have proved best among the leguminous covers, and millet, rape and buckwheat have been best among the non-leguminous. Their influence on the moisture supply, in both fall and spring, is often more important than their relation to humus and plant food.

(5) Alfalfa for five years has proved very effective as a mulch producer and as a permanent orchard cover, when its growth is prevented from competing directly with the tree roots. The exact effects of the latter competition and the relative values of alfalfa and certain other plants as permanent orchard covers have not yet been determined.

Results in Orchards of Early Bearing Age.

The next group of results is obtained from orchards ranging from six to twenty years old, if we begin with the age of the youngest at the start and finish with that of the oldest at present. The experiments directly concerned here are the first three indicated in Table I, and they each involve the entire plan shown in Fig. I. These experiments were started in 1907, in orchards already planted, and hence it was not always possible to get all the conditions as uniform as might be desired. Such irregularities as are present, however, have been corrected for in our calculations so far as possible. Owing to some serious attacks of "collar-rot" and other diseases, also, one of these experiments, M217, was terminated in 1912 and a similar one started in another part of the orchard.

The results thus far obtained from those experiments on the yield, growth, average size and color of apples are shown in Tables V, VI, VII, and VIII, respectively. The yields, color and average size are given for the 5 year period from 1908 to 1912 inclusive, thus omitting the yields of 1907 which naturally were affected but slightly, if at all, by the treatments of the first year. In the growth, however, the averages are given for the entire 6 year period beginning with 1907. The yields are obtained by weighing and recording all the fruit from each tree, and the growth is determined by measuring all the trees practically annually at definite points on their trunks.

The data on average size and color are obtained by the random-sample method. This means that as the fruit is picked and weighed, a sample is taken at random from each basket and of sufficient size to make at least two bushels of fruit of each variety from each plot. This sample is weighed, counted and carefully examined for amount of color. The averages for each year on all characters except growth are brought together and averaged to obtain the present data on each experiment. These mean values in turn are averaged in each of the tables to obtain the various averages shown in them. In the growth tables, the figures given are the average increases in trunk girth for the whole period covered. The results secured are shown in the following tables:

TABLE V.—INFLUENCE OF CULTURAL METHODS ON YIELD (YOUNG BEARING ORCHARDS).

(Average annual yields per acre during last five years, 1908-1912.)

Treatment.	Experiment.	Tillage.	Cover Crop.	Mulch.	Sod.
		bu.	bu.	bu.	bu.
WITHOUT FERTILIZATION	217	96.0	121.0	174.3	140.1
	218	129.5	110.4	108.5	110.4
	219	21.9	23.6	55.5	19.9
Average per Acre		79.1	85.0	112.7	90.1
Rank		4	3	1	2
WITH MANURE	217	169.1	151.5	213.0	260.5
	218	155.8	145.2	105.9	115.9
	219	52.3	30.2	59.1	35.0
Average per Acre		125.1	109.0	126.0	137.1
Rank		3	4	2	1
WITH COMPLETE FERTILIZER	217	170.4	195.3	218.2	187.7
	218	182.3	133.3	115.3	126.6
	219	47.5	53.7	44.4	33.5
Average per Acre		133.4	127.6	129.3	115.9
Rank		1	3	2	4

TABLE VI.—INFLUENCE OF CULTURAL METHODS ON GROWTH (YOUNG BEARING ORCHARDS).

(Average increases in trunk girth, six years, 1907-1912.)

Treatments.	Experiment.	Tillage.	Cover Crop.	Mulch.	Sod.
		In.	In.	In.	In.
WITHOUT FERTILIZATION	217	9.10	9.69	9.05	8.92
	218	9.89	10.09	10.71	8.78
	219	10.01	8.94	10.87	7.65
Average gain		9.67	9.57	10.21	8.45
Gain over sod		14.4%	13.3%	20.8%	.....
Rank		2	3	1	4
WITH MANURE	217	9.88	9.13	9.19	9.06
	218	11.15	10.32	10.52	10.55
	219	11.65	11.20	11.75	10.06
Average gain		10.87	10.22	10.47	9.89
Gain over sod		28.6%	21.00%	23.9%	17.00 %
Rank		1	3	2	4
WITH COMPLETE FERTILIZER	217	9.58	10.22	10.29	8.51
	218	9.38	9.63	11.25	9.63
	219	11.19	11.37	11.92	10.08
Average gain		10.05	10.41	11.15	9.41
Gain over sod		18.9%	23.2%	32.00%	11.4 %
Rank		3	2	1	4

TABLE VII.—INFLUENCE OF CULTURAL METHODS ON THE SIZE OF APPLES (YOUNG BEARING ORCHARDS).

(Average weights of fruit in ounces, five years, 1908-1912.)

Treatments.	Experiment.	Tillage.	Cover Crop.	Mulch.	Sod.
		oz.	oz.	oz.	oz.
WITHOUT FERTILIZATION	217	4.90	4.82	5.22	4.94
	218	5.68	6.01	6.14	5.68
	219	3.81	3.73	4.74	4.30
Average size	.....	4.80	4.85	5.37	4.97
Gain over sod	.....	—3.4%	—2.6%	8.04%	.....
Rank	.....	4	3	1	2
WITH MANURE	217	5.53	4.98	5.42	5.42
	218	6.15	6.26	5.91	5.84
	219	4.63	4.43	4.83	4.56
Average size	.....	5.44	5.22	5.39	5.27
Gain over sod	.....	9.5%	5.03%	8.44%	6.03%
Rank	.....	1	4	2	3
WITH COMPLETE FERTILIZER	217	4.85	4.99	5.72	5.41
	218	5.48	6.00	6.44	5.83
	219	4.55	4.27	4.52	4.63
Average size	.....	4.96	5.09	5.56	5.29
Gain over sod	.....	—.2%	2.4%	11.9%	6.44%
Rank	.....	4	3	1	2

TABLE VIII.—INFLUENCE OF CULTURAL METHODS ON THE COLOR OF APPLES (YOUNG BEARING ORCHARDS).

(Average per cent. of fruit colored one-half or more, five years, 1908-1912.)

Treatments.	Experiment.	Tillage.	Cover Crop.	Mulch.	Sod.
		Per cent.	Per cent.	Per cent.	Per cent.
WITHOUT FERTILIZATION	217	71.1	67.5	77.1	81.0
	218	76.4	83.2	74.8	76.0
	219	77.5	72.6	82.9	86.2
Average color	.....	75.0	74.4	78.3	81.0
Per cent. gain over tillage alone	.....	.....	—0.7	4.4	8.1
Rank	.....	3	4	2	1
WITH MANURE	217	64.0	68.8	64.3	68.9
	218	64.5	73.9	69.6	74.7
	219	66.0	74.5	63.3	77.2
Average color	.....	64.8	72.4	65.7	73.6
Per cent. gain over tillage alone	.....	—13.6	—3.5	—12.35	—1.8
Rank	.....	4	2	3	1
WITH COMPLETE FERTILIZER.	217	64.6	64.6	69.7	72.7
	218	74.7	75.7	69.6	70.0
	219	70.0	71.6	74.2	77.3
Average color	.....	69.8	70.6	71.2	73.3
Per cent. gain over tillage alone	.....	—6.9	—5.8	—5.1	—2.2
Rank	.....	4	3	2	1

These results are naturally much more complicated than those in the young orchards considered above. The differences, also, are less distinct and much less uniform in their trend in many cases, and the relative values of the several treatments are more variable in the different soils and localities. Part of this variability is doubtless connected with the natural unsteadiness, in yield especially, that is generally characteristic of trees in their early stages of bearing. The extent and importance of the latter influence, however, can only be determined by further results and perhaps by additional experiments.

But in spite of the present difficulties, a few points are fairly clear. In the first place, it may be noted that the sod treatment has uniformly resulted in the poorest growth and the best color of any of the treatments. This is doubtless simply due to its hastening influence on maturity. On yield, thus far, the sod has usually exerted a stimulating influence, which is especially noticeable in connection with manure. The exceptionally high average in this case, however, can be traced primarily to the unusual yields in experiment 217, and in the other two experiments it is notable that four out of six of the other treatments with manure are against this average. The same is true of the sod average obtained in the series without fertilization, as shown in Table V.

The present yield benefits from sod, also, are evidently being secured primarily as a result of mild injury, as is shown by the fact that sod trees are making the least growth of any of the treatments, and in the series receiving commercial fertilizer they are also showing the lowest average yield. Grass sod growing over tree roots, therefore, must generally be considered an objectionable treatment.

The Value of a Mulch: In terms of fruit, it will be noted in Table V that our annual mulch applications alone have given an average increase of about 35 bushels of apples in two of the experiments, and has resulted in no gain over sod in the third. These differences might be greater if the trees were larger and in another experiment on older trees, as shown in Tables IX and XIII, it will be observed that the mulch has given a maximum annual gain of 76 bushels per acre for the last four years. In the absence of fertilization during three of those years, the average annual gains from the mulch were 22 bushels per acre, which also happens to be the average shown by it for all three of the experiments in Table V.

When fertilization is added in these young or "adolescent" orchards, however, the benefits from the mulch have usually been reduced, and in the presence of manure they have disappeared entirely, so far as the average yield is concerned. In other words, on these medium-sized trees, the three-ton mulch has apparently been heavy enough to interfere somewhat with the action of the manure. This interference has been less with the commercial fertilizers, especially in the case of growth, and it does not appear at all as shown later in Experiment 221.

From the present data, therefore, it appears that such a mulch as we are using can not be relied upon for annual gains of more than 20 to 35 bushels of apples per acre in the younger orchards, and not more than 75 to 80 bushels in those more mature. From this it is evident that one is restricted to the use of relatively cheap materials in maintaining the mulch, if it is expected to show a definite profit. Where the materials for it can be grown between the rows, or can be obtained in such form as swamp hay, buckwheat straw, or possibly damaged straw of other kinds, its use seems to be practical in many cases, though not in all.

As compared with the other treatments in these experiments, it will be noted that the mulched trees are usually retaining their superiority in everything but

color of the fruit. Their margin is considerably smaller, however, than that in the recently planted orchards discussed earlier, and in a few cases it disappears entirely in favor of some of the tillage treatments. The latter cases are found chiefly in the heavy soil of experiment 218, which is rather unexpected because this soil is almost the same as that in our experiments 331 and 333 above, in which the mulch has proved very satisfactory.

Incidentally it may be noted that thus far the tillage and covercrop treatment has surpassed the mulch in but a single average and that is the rather surprising one of color, when used in connection with manure. In a few other individual cases—especially in experiment 218—the covercrops have also excelled slightly in certain other characters. In general, however, with the exception of experiment 218, the mulch treatment has proved very satisfactory for orchards of the present age, when the cost of materials is not too high.

The Value of Cover Crops: Just as in the young orchards considered above, cover crops again have very largely failed to come up to expectations. In yield, as compared with tillage alone, they have shown a couple of 25 bushel increases—both in experiment 217. In practically all other cases, however, their gains either have been very small or totally lacking, with the results favoring the other treatments.

These results again may be connected, to some extent, with local conditions and with the unsteadiness and youth of the trees, though the exact importance of these influences is not at all certain. In two of our older orchards, experiments 221 and 338, the benefits of tillage and cover crops together have seemed to be quite important, amounting to about 122 bushels per acre annually as compared with sod in the latter case.

Just how much of this is due to the cover crop, however, can not be determined from the particular combinations that are under comparison in those experiments. On the other hand, the present series does contain comparisons bearing directly on the value of cover crops; they give the average annual returns for 5 years from three experiments on three markedly different soil types; and their indications are certainly not without significance. These indications are to the effect that many orchards, and especially those in the early stages of bearing, are not likely to be materially benefited by the addition of cover crops. Where the humus is very deficient, and perhaps in older orchards, cover crops may be expected to give better results.

Other matters, such as the relation of cultural methods to fertilizer response or utilization, the influence of fertilization in reducing the differences between the various cultural methods, the relative values of manure and the present commercial fertilizer in connection with the different treatments, and something of the relation between soil type and the response to all these treatments, might also be considered here if space permitted. They can be seen fairly well by examining the tables themselves, however, and some of them will be referred to briefly in connection with results that follow.

Results from Mature Orchards.

One of the following orchards can hardly be considered mature, since it is now only 10 years of age, but it is considered in Table IX along with the 24 year old trees of experiment 338 because the experiments are of the same type and they thus admit of briefer treatment. These two experiments, 336 and 338, are what we have called "combination experiments" because they involve two

distinct series of plots—one on fertilizers and the other on cultural methods. Only the latter series is considered in Table IX and the treatments correspond with numbers IV, VII, and X of the general plan shown in Figure I. No fertilization has been used on the present plots except once, in 1911, when a commercial fertilizer analyzing about 6-10-6 was applied uniformly over all the treatments at the rate of about 600 pounds per acre. The results from these two experiments on the four characters of yield, growth, size and color are as follows:

TABLE IX.—INFLUENCE OF CULTURAL METHODS ON YIELD, GROWTH, SIZE AND COLOR IN APPLES.

(Annual yield per acre and total growth increases, 1908-1912, and average size and color, 1909-1912.)

	Experiment 336.	Experiment 338	Total Yields.	Yield Inc. over Sod.	Inc. in tr-girth.	Growth Inc. over Sod.
	bu.	bu.	bu.	per cent.	in.	per cent.
Covercrop	47.8	312.9	1142.0	72.5	8.33	41.4
Mulch	57.0	266.4	1030.2	55.6	7.30	23.9
Sod	23.1	190.2	662.4	.....	5.89	.....

	Average Size in 336.	Average Size in 338.	Average Size.	Size Inc. over Sod.	Average Color.	Color Inc. over Tillage.
	oz.	oz.	oz.	per cent.	per cent.	per cent.
Covercrop	6.77	4.24	5.50	12.0	62.0	.....
Mulch	6.48	4.06	5.27	7.3	69.9	12.7
Sod	6.01	3.82	4.91	.....	74.4	20.0

These results show greater benefits from the tillage and cover crop treatment than any of the experiments thus far considered. In every character except color this treatment here shows very decided gains over sod alone, and with one additional exception, it is also surpassing the mulch by considerable margins. To be more particular, as compared with sod, the cover crop trees are making 41 per cent. better growth, 72 per cent. better yields which amounts to more than 122 bushels per acre annually in experiment 338, and the fruit is 12 per cent. larger. As against this, the sod fruit is 20 per cent. higher in color. Their gains and losses in comparison with the mulched trees are similar, but with smaller differences, and as usual in the younger orchard the mulched trees are again showing the better yields by about 10 bushels per acre annually.

These results are likely to be considered much more "orthodox" than those in the three earlier experiments, because they are more nearly in line with much of the current opinion. The other results are more extensive, however, and are just as truly the responses of the trees concerned. The exact effects and the relative values of cultural methods, therefore, as well as those of fertilization, are apparently very much influenced by local conditions.

As already noted also, it is impossible in the present cases to determine how much of the credit is due to the cover crops and how much to the tillage. In view of the rather unfavorable results from cover crops in the direct comparisons above, however, the present benefits can hardly be largely or positively credited to them without more definite evidence.

Relative Commercial Quality of the Fruit. Assuming that commercial quality in apples is largely dependent on the size and color of the fruit, it would seem to be almost a triple tie between the treatments here, since the gains in size are practically off-set by the losses in color and vice versa. If there is any advantage it is probably with the mulch, as its size seems to be satisfactory and its color is distinctly higher than that of the cover crop fruit. On the same basis and assuming equal soundness and perfection, the mulched fruit in experiments 217-19 would doubtless be ranked first in commercial quality in about two-thirds of the cases, or in about six of the nine opportunities for comparison. The high average size generally shown by the mulched fruit, when the crops are not excessive, is clear evidence of the excellent moisture-conserving ability of a good mulch, and this has also been thoroughly demonstrated experimentally.

Thorough and proper tillage will also conserve the moisture very satisfactorily, but its action on the color of the fruit is very similar to that of too much nitrogenous fertilizer, the result in either case being a gray and unsightly color instead of a rich red, which greatly detracts from its saleable qualities. Other characters, however, such as full development in size, and a normal period of ripening, are also very important in securing the best dessert and keeping qualities, and where the tilled fruit can excel distinctly in these respects, it may often more than overcome its usual deficiencies in color.

The keeping quality in this connection is obviously of sufficient importance to warrant definite and extensive tests of average fruit from the different treatments, but as yet the facilities have not been sufficient to get this accomplished.

Results from the Fassett Orchard.

This orchard is fully mature, since its age as shown in Table I is now 40 years. Its results therefore should be typical of orchards in the fully mature class. Our experiment here was started in 1907, and the treatments involved are those numbered IV to IX in the general plan stated in Figure I. The other treatments in this plan were omitted because of limitations in the experimental area available.

The results of the present treatments in respect to the four characters under consideration are shown in Tables X and XI. The yields are given for four years only, excluding the first two years instead of one in this case, so as to give the same number of full and off years to each treatment. This is desirable in the present experiment because of the marked alternations in bearing in some of the plots, with their full crops not all coming on the same years. The trees are set at the rate of 27 to the acre.

TABLE X.—INFLUENCE OF CULTURAL METHODS ON YIELD AND GROWTH, EXPERIMENT 221.

(Annual yields per acre, 1909-1912, and the average growth, 1907-1912.)

Treatments.	Average yields, 4 years.		Growth, 6 years.	
	Tillage and Covercrop.	Sod Mulch.	Tillage and Covercrop.	Sod Mulch.
	bus.	bus.	in.	in.
WITHOUT FERTILIZATION	345.9	322.8	5.39	3.19
Gain over mulch	23.1	.....	2.20	.....
Relative gain	7.2%	.....	69.00%	.....
Rank	1	2	1	2
WITH MANURE	382.5	513.5	6.72	4.26
Gain over lowest	.....	131.0	2.46	.....
Relative gain	.....	34.2%	57.7%	.....
Rank	2	1	1	2
WITH FERTILIZER	372.5	438.9	6.06	4.16
Gain over lowest	.....	66.4	1.90	.....
Relative gain	.....	17.8%	45.6 %	.....
Rank	2	1	1	2

TABLE XI.—INFLUENCE OF CULTURAL METHODS ON SIZE AND COLOR, EXPERIMENT 221.

(Average weights and color of fruit, 1907-1912.)

Experiment 221.	Average Size.		Average color.	
Treatments.	Tillage and Covercrop.	Sod Mulch.	Tillage and Covercrop.	Sod Mulch.
			Per cent.	Per cent.
WITHOUT FERTILIZATION	4.79 oz.	5.22 oz.	68.0	79.9
Gain over covercrop alone	.....	9. %	.....	11.9
Rank	2	1	2	1
WITH MANURE	5.45 oz.	5.33 oz.	65.9	72.6
Gain over covercrop alone	13.8%	11.3%	—2.1	4.6
Rank	1	2	2	1
WITH FERTILIZATION	5.16 oz.	5.37 oz.	68.9	73.1
Gain over covercrop alone	7.7%	12.1%	.9	7.5
Rank	2	1	2	1

Taken as a whole, these results show a rather marked distribution of the honors, neither method showing a uniform superiority over the other on all characters. The mulched fruit as usual is superior in color. It is also ahead in average size in two cases out of three, and its deficiency in the third is so slight that its general superiority in color would probably entitle it to rank first throughout in commercial quality.

On the other hand, we find that here, as in the other mature orchard, the trees receiving the tillage and cover crop treatment are making uniformly the largest growth. Whether or not this is also the best growth for trees of this age is less certain. There are some indications that the two plots receiving fertilization, in addition to the tillage and cover crops, are now making rather too much growth for best results in yield, which is naturally the important item in a mature orchard,

and in it unnecessary growth is objectionable. In the *absence* of fertilization, also, the cover cropped trees are excelling in yield, by about 23 bushels annually, and this margin would be materially increased if the yields for the entire period were included. This superiority is very decidedly reversed, however, when fertilization is added to both treatments. Under the latter conditions, the mulched trees are giving better annual returns than any combination involving tillage and cover crops that we have tested thus far. Their yields, also, have been much steadier than those in the following table, which shows the annual yields from 1907 to 1912, in bushels per plot of about an acre.

TABLE XII.—INFLUENCE OF CULTURAL METHODS WITH FERTILIZATION ON STEADINESS OF YIELD.

(Yields in bushels per acre annually, in Experiment 221.)

Treatment.	1907	1908	1909	1910	1911	1912	Average last 4 years
	bus.	bus.	bus.	bus.	bus.	bus.	bus.
Mulch and manure.....	34	215	493	526	621	413	513.5
Covercrop and manure....	117	145	493	216	612	188	382.5
Mulch and fertilizer	38	199	409	560	370	416	438.9
Covercrop and "	129	122	639	118	573	161	372.9

In the presence of fertilization, the difference here between the mulched and tilled trees in steadiness of yield is very striking. The tilled trees on the one hand are showing a regular and distinct off-year, while those receiving the mulch have shown steady increases in yield up to about 600 bushels per acre, followed by a drop of only about 200 bushels. In the latter trees, the off-year has not yet been eliminated entirely, but its influence has been very greatly reduced. At the present time, the average deficit on the tilled and fertilized trees in this experiment is practically represented by the losses in their off-years.

The fundamental cause of this difference is very important. Practically, it seems that the chief difference in treatment lies in the fact that the tree roots are materially disturbed in one case and not in the other. Strange to say, this disturbance does not seem to have injured the growth, but it, or some other influence not yet recognized, has evidently reduced the yields very materially. The harmful effect on yield of too much pruning of tree tops is now generally accepted, hence may it not be true that similarly harmful effects are associated with any material pruning of the roots?

These and other relatively unfavorable results with the ordinary methods of orchard tillage suggest the advisability of shallower plowing over tree roots—not deeper than four inches at the most—and where conditions permit, it would seem advisable to displace the plow entirely, either with a double-action disc or cutaway harrow, or with a mulch.

IS FERTILIZATION MOST EFFECTIVE ON TILLED OR UNTILLED TREES?

Judging from the Fassett Experiment alone, one would answer this question positively in favor of the latter trees, in Table X for example, the addition of manure to the tillage and cover crop treatment has resulted in a gain of only

37.6 bushels per acre, while the corresponding gain from its addition to the mulch is 190.7 bushels or over 5 times the gain on the tilled trees. With fertilizers, similarly, the gains are 27.6 bushels on the tilled trees and 116.1 bushels on those receiving the mulch. Incidentally, the thinner mulch, under these larger trees, shows none of the interference with fertilization noted in the experiments of Table V.

Similar inferences may be drawn from the large benefits obtained in our untilled fertilizer experiments in the Johnston and Brown orchards,* as compared with those in other experiments involving tillage, though such comparisons are naturally much less direct and exact than those in the Fassett orchard.

In Table V, however, with the exception of manure on sod, we see better average gains in yield from fertilization in connection with tillage, and this is especially marked in experiment 218. In Table VI, similar results are apparent in regard to growth, the most striking gains from fertilization in this case being shown by the tilled trees of experiment 219. The benefits from fertilization, therefore, are by no means confined to untilled trees, and in some cases its utilization is evidently better when accompanied by some cultivation.

The exact conditions associated with these different kinds of response have not yet been determined, and this is one of the questions intended for further study, by chemical and physical means, as soon as the necessary facilities are available.

The Relative Importance of Fertilization.

Throughout these experiments, and especially in the older orchards, the importance of fertilization has been very apparent. In most of the results from Table V on, it will be observed that the addition of fertilization, either in manure or in commercial form, has largely neutralized the differences developed by the various cultural methods when used alone. In some cases also, it has even distinctly reversed these differences. Similar, though not exactly analogous data, bearing on the same general question, may be obtained from the Johnston experiment by comparing the yields produced on its cultural-method plots with those from certain of its plots receiving fertilization.

The figures resulting from this comparison are shown in Table XIII. As already noted in connection with Table IX, the cultural-method plots in this experiment have received one uniform application of fertilizer, the application being made in 1911. It has not yet influenced the yields very materially, with the possible exception of the mulched trees in 1912, but the annual differences for the three preceding years are also given, thus permitting any further comparisons that may be desired. The sod here is not very heavy, owing to the practically complete occupation of the ground by the trees.

*The fertilizer experiments in these orchards are discussed in our bulletins and annual reports on orchard fertilization.

TABLE XIII.—RELATIVE INFLUENCE OF CULTURAL METHODS AND FERTILIZATION ON YIELD.

(Annual yields per acre, during four years, 1908-1912, in Experiment 338.)

Treatment.	An. Yields per acre.	An. Gain over Sod.	An. Gains 3 years, without fertilization of the Cult. Methods.
	bus.	bus.	bus.
Sod	190.2	.....	.....
Sod mulch	266.4	76.2	22.
Tillage and covercrop	312.9	122.7	100.
Sod plus phosphate and potash	277.6	87.4	123.
Sod plus nitrogen and phosphate	542.0	351.8	451.
Sod plus manure	637.0	446.8	390.

In the present table, it will be noted that sod alone has given a 4-year average yield of 190 bushels per acre. The addition of a mulch has raised the average by 76 bushels, and the substitution of tillage and cover crops has rasied it still further, to a gain of nearly 123 bushels per acre, which is the maximum gain obtained thus far in our experiments from the latter combination.

In the latter half of the table, however, we find that the addition of phosphate and potash to sod, without any cultivation, has resulted in an average gain of 87 bushels per acre, while the addition of nitrogen and phosphates has given an increase of about 352 bushels, and manure now shows the enormous gain over sod alone of more than 446 bushels per acre annually. These latter increases are thus about 3 to 4 times as great as the best of those obtained from modifications in cultural methods alone.

These and other results given above indicate that in many cases the character of the fertilization is of greater importance than the particular cultural method followed. This is not always true, however, and before doing any extensive fertilizing of orchards, we always recommend a preliminary local test, on the general plan described in our recent reports and bulletins on this subject. Similarly, before making any radical changes in a cultural method, it is always advisable to give the proposed change a careful trial on a typical portion of the orchard, unless one already has undoubted evidence of the value of the change for his particular conditions.

Q.—It gives better color on your fruit?

PROF. STEWART: Yes, and that brings up another question, the relation of these things to color. I may say that we get regularly more color on the mulch fruit and on the sod fruit. We get more color on sod fruit than any other. After that comes the mulch and after that the tillage, and then tillage and cover crop. Tillage alone and tillage and cover crop run along about together. As to the relative size of the fruit where you use a very definite mulch the mulch fruit has been in general as large if not slightly larger than the other fruit. That also is different from the results obtained by some other experimenters, but that is the result that has been obtained in our experiments.

Q.—What about insect pests?

PROF. STEWART: I have not noticed any material difference in the amount of insect injury in one case than another. That may be due to the fact that they run side by side.

Q.—What about fungus?

PROF. STEWART: I have not noticed any material difference there. It is quite possible you might get a little more fungus and a little more insect injury from the mulch system than the other. In fact it is very probable that that might result, but we have not noticed that in these experiments yet. I may also say that in the case of the mulch you have to give special attention to avoid injury by mice or rats. We have had some trees as much as eight inches in diameter girdled by mice in connection with the mulch system, and also we have had some injured in the tillage system where a little growth was permitted to remain near the trees. If you are going to use the mulch system you must give special protection against the danger of girdling. I may say there is this against the mulch system that it may increase somewhat the danger from fire. It has those objections. The general conclusion that we might draw from this work is that you are not confined to a single cultural method, but you can get along very well either on young trees or old by means of tillage or of tillage and cover crops. You can get along very well with those and with certain things make either one of them more advisable in your section or in your orchard, but there is not any one of them that seems to be first and foremost throughout our experiments.

Q.—What about foliage?

PROF. STEWART: Especially when we add fertilizer we get practically as good foliage on one as the other. Of course sod is the least desirable of any. In fact, it is to be avoided, but if you have got to use sod alone you will find it to your great satisfaction if you can get a manure or proper fertilizer on that land. You can get just as good foliage and as much fruit, and a little better color. That is the result of our experiments. It has simply as I say widened our horizon on the use of cultural methods. I would like to caution you against too deep tillage in case you are tilling your orchard, and perhaps look towards the use of double action discs rather than too much plowing. Of course in some cases if the soil is particularly hard and refractory you may have to plow anyway. The double action disc may not be sufficient, but in that case I should try not to plow more than four inches deep.

MR. ONSLOW: Does the action of cultivation bring the roots very much to the surface?

PROF. STEWART: It has this effect, that there will be very many more roots lower than under tillage, but it is an interesting fact that when you go below that, that is taking an area of six to fifteen inches, that there will be about the same number of roots in that area regardless of the system, and the difference is that in the absence of tillage you have a great number of roots clear on up to the four inches than you do under the tillage system. In other words you have a more abundant root system under the sod than you do in the other case, and it is a strange but true fact in our soils at least that the great majority of feeding roots in apple trees are in the area from about three to ten inches. That is where the vast majority of feeding roots are to be found, and in many cases they are about six inches. That is about where you find them.

MR. ONSLOW: Does the same thing refer to peaches and plums?

PROF. STEWART: To a very large extent, yes. Wherever you have seen the roots of trees exposed by cultivation if you will think it over I think you will recall that the roots of most of our trees are surprisingly shallow and spread out.

Q.—How far?

PROF. STEWART: I have followed apple roots for over forty-six feet on thirty-

five year old Spy trees. Just think about that a minute. We plant a tree say 40 by 40. Now, there were Spy tree roots reaching 46 feet, and in that case the roots would go clear over to the other tree, and six feet beyond, and the other tree would have been sending roots over past it. Many times we plant still closer than that. We consider all the time the question of the crowding of the tree tops as the important thing in setting out trees, whereas as a matter of fact we ought to consider to a considerable extent at least the crowding of the tree roots in those areas.

RESOLUTIONS OF THE FRUIT GROWERS' ASSOCIATION PASSED AT THE CONVENTION, 1912.

Resolved that the members of the Ontario Fruit Growers' Association in Convention assembled desire to express to the Hon. Mr. Duff, Minister of Agriculture for the Province of Ontario, their appreciation of the interest taken by the Department of Agriculture in the fruit growing industry of the Province, more particularly during the past year in the appointment of Mr. L. Caesar as Provincial Entomologist, whose work has already proved of very great value and promises to become of still greater importance.

The appointment of a Market Commission for the western Provinces has also resulted in the placing in the hands of the shippers of the Province of a large amount of information of considerable value. It is hoped that this office will be continued and extended in its scope during the season of 1913.

The continuation of the annual grant to the Exhibition Board has also been very acceptable, and has enabled the Board to instal and maintain an exhibition which is a credit to the Province and a satisfaction to all concerned.

The thanks of this Association are also hereby tendered to the Mayor, Board of Control and members of the City Council of Toronto for the free use of the Horticultural Building during the present week in which to hold the exhibition, also for the increased grant to the Exhibition Board which has enabled them to largely extend the usefulness and scope of the exhibition.

Believing that one of the principal reasons for the comparatively high prices of fruit products to the consumer is the lack of proper markets, etc., we would request that the matter of better market facilities for the disposal and distribution of the large quantities of fruit which is now seeking an outlet in Toronto, receive the serious consideration of the City Council in the near future.

The thanks of this Association are also hereby tendered to the Hon. Mr. Burrell, Minister of Agriculture for Canada, for the great interest he has displayed in regard to improving conditions in the various fruit growing sections of the Dominion, and in largely increasing the staff of inspectors as requested at the last Dominion Fruit Conference. It is hoped that the scope and powers of these inspectors may be considerably enlarged so that they may be enabled to take cognizance of the handling of fruit by the various carrying companies, and, also, of the shipment of unripe and unwholesome fruit to the markets by irresponsible parties.

In the opinion of this Convention of the Fruit Growers' Association of Ontario, it is advisable in the interests of the fruit industry that the Provincial Government take over the appointment of the local inspectors for the eradication of fruit pests

and diseases, and place in these positions men specially trained for the work; and this Association respectfully requests that the Fruit Pests Act be amended in these particulars at the next session of the legislature; copies of this resolution to be forwarded to the Premier and the Minister of Agriculture.

Resolutions of Condolence.

We desire to record our deep regret on account of the death, during the past year, of Prof. John Craig, of Cornell University, a gentleman long and favorably known in connection with horticulture in Canada.

We have also just learned, with sincere sorrow, of the sudden death of Major R. W. Sheppard, of Como, an honored member of our sister Association, the Quebec Pomological Society.

We extend to the families of both these gentlemen our sympathy in their hour of bereavement.

The Chairman: This report is not by any means as full and complete as it was hoped it might have been, but a number of resolutions have been passed in committee and they are now presented to you.

Mr. Onslow: I would move in amendment to the resolution that this Association emphasize their appreciation of the work undertaken by Mr. McIntosh in reference to transportation, etc.

Mr. Thompson: I second that. I would also move a resolution be passed that the Association appreciates very much the kindness of Professor Stewart in coming here to deliver two such interesting and valuable addresses.

Mr. Robertson: May I add in connection with the subject of nursery control that our Committee met yesterday and did not come to any definite conclusion, but recommended that more stringent measures be taken in connection with fumigation, and that it be left to the Committee of those who have to deal with it to see that the boxes are thoroughly fumigated. We talked the thing over, and we have taken that matter into our serious consideration before, and there seems to be no practical method. The nurserymen thought there ought to be some added price to the nursery stock to cover these things as some compensation for their extra trouble. It seems that some of the larger nurseries import some of their stock and they have no guarantee, and they mix it with the Canadian nursery stock and fill their orders. There have been some cases where people have failed in getting the buds from the proper trees. Of course we as fruit growers are the sufferers, and with peaches it is sometimes difficult to get a tree that is true to name. With apples there is a variation in the growth which an experienced eye can locate. It was left at that, but they suggest dealing only with reliable nursery firms. We have failed to come to a conclusion as to what that embraces.

The Chairman: They desire to report progress and ask leave to continue their investigations, but you ask for more stringent control with regard to fumigation?

Mr. Robertson: That is all.

The Chairman: This Committee will have full authority to sit during the coming year and see if they cannot arrive at some conclusion with reference to the control of our nurseries, and arrangements that will be more satisfactory to the fruit grower.

Prof. Crow: I would like to speak in support of Mr. Onslow's resolution. That resolution comes closer to what I had in mind than anything which has been

offered. I have not attended all the sessions of this convention, but so far as I am aware there has been nothing definitely said with regard to the subject of co-operation. I know the subject has been broached two or three times. Now, I venture to make some remarks for the reason that I believe that Co-operation in the handling and selling of our fruit products is not making the progress it should make. I know there are a few districts where co-operative associations are doing excellent work, and in which the co-operation spirit seems to be on a permanent and sound basis, but I believe outside of these few districts the general idea of co-operation is not spreading and is not advancing. At least if it is doing so it is doing so very, very slowly. Now, I should like to see much more interest taken in the general question of co-operation than has been evidenced. I know it is in the minds of the growers, but so far as I know it has not come to the surface at this convention. In my opinion it is time it was made somebody's special business to spread the propaganda of co-operation. I believe the fruit interests of this country require the development of the co-operation idea throughout the country-side, generally speaking. We need it. We have got to have that means of handling our products. Our growers are not learning as much as they should about co-operation. They are not getting posted and they are not taking up the work. I believe it is time we made it somebody's special business to talk the propaganda up and assist in organization. I quite realize that as fruit growers we cannot go to the Government and ask for a grant to be used in the organization of co-operative associations, because we would be considered as encroaching on the realm of the private dealers, and probably not without reason; but at the same time in other countries Governments do make grants to what is called the Organization Fund of Co-operation Societies, and under the organization fund an officer may be employed whose special duty it is to look after the work I have in mind. Now, in the resolution presented a few moments ago it was suggested that the general subjects of transportation, and so on, as handled by Mr. McIntosh be consistently handled by him. It was also suggested in another resolution that a committee be appointed to investigate the general situation with regard to the handling and selling of products. It is my opinion that if the fruit men would get together they would not be very long in finding out exactly what they wanted. I believe we know what we want. I do not know whether it is necessary to appoint a commission, but I believe we do know just about what we want, but the difficulty is when we come to ask for anything we take forty different ways of doing so. If we could work together I think this thing would work out very satisfactorily indeed.

Mr. Smith: I would like to hear Prof. Crow put what he has said in the form of a resolution so that something may be done. To my mind the greatest need of the fruit grower is what Prof. Crow has outlined. I think something done in that line in a practical way will do more than appointing a commission of enquiry such as is suggested. I do not know whether it would be in order or not, but it strikes me by the report presented by Mr. McIntosh that he is just about the kind of man we want to go through the country and preach the gospel of co-operation.

Prof. Crow: I should much prefer not to put that resolution. In my professional capacity I think it would hardly be proper. I should like to see sufficient interest taken in the subject by the fruit growers for that resolution to come from one of them.

Mr. Thompson: It was with a good deal of hesitation that Mr. McIntosh was appointed at first owing to the question of expense. However, they decided to do it, and I am glad that the results have proved satisfactory and that we are all satisfied, and I think possibly if it were left in the hands of the incoming Board that that work should be followed up, coupled with co-operation, so that there would be more active work done during the coming year along those lines than has been in the past. I think perhaps that would cover the point. If necessary we might add to the resolution of Mr. Onslow that the work of Mr. McIntosh should include that. Of course he said it should be continued, and that the work of co-operation be also added to transportation. I would amend it by adding the word co-operation.

Mr. Andrews: It seems to me it might not be a bad plan to appoint a committee to work on this during the coming year. It is a very big subject. There is one idea which I suppose this Association could hardly deal with, but it has always seemed to me the growers should have a wholesale house in all the big cities. How this is to be brought about I do not know. If a committee was appointed they might be able to make some suggestions and some good come out of it.

The Chairman: It was decided to have these standing committees meet in January, and the suggestion of Mr. Andrews will probably have consideration at that time.

The President declared the resolutions passed as amended.

Mr. Onslow: I would like to mention this, that every man coming from a different part of Ontario can help us all greatly by interviewing his own member and making him cognizant of the importance of our Association, so that when this matter comes up in the House he would be anxious to see that we get proper financial assistance.

EIGHTH ANNUAL REPORT

OF THE

ONTARIO
Vegetable Growers' Association

1912

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE)

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To His Honour Sir John Morison Gibson, Knight Commander of the Most Distinguished Order of St. Michael and St. George, a Colonel in the Militia of Canada, etc., etc., etc., *Lieutenant-Governor of the Province of Ontario.*

May it Please Your Honour:

I herewith present for consideration of your Honour the Annual Report of the Ontario Vegetable Growers' Association for 1912.

Respectfully yours,

J. S. DUFF,

Minister of Agriculture.

Toronto, 1913.

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Ontario Vegetable Growers' Association

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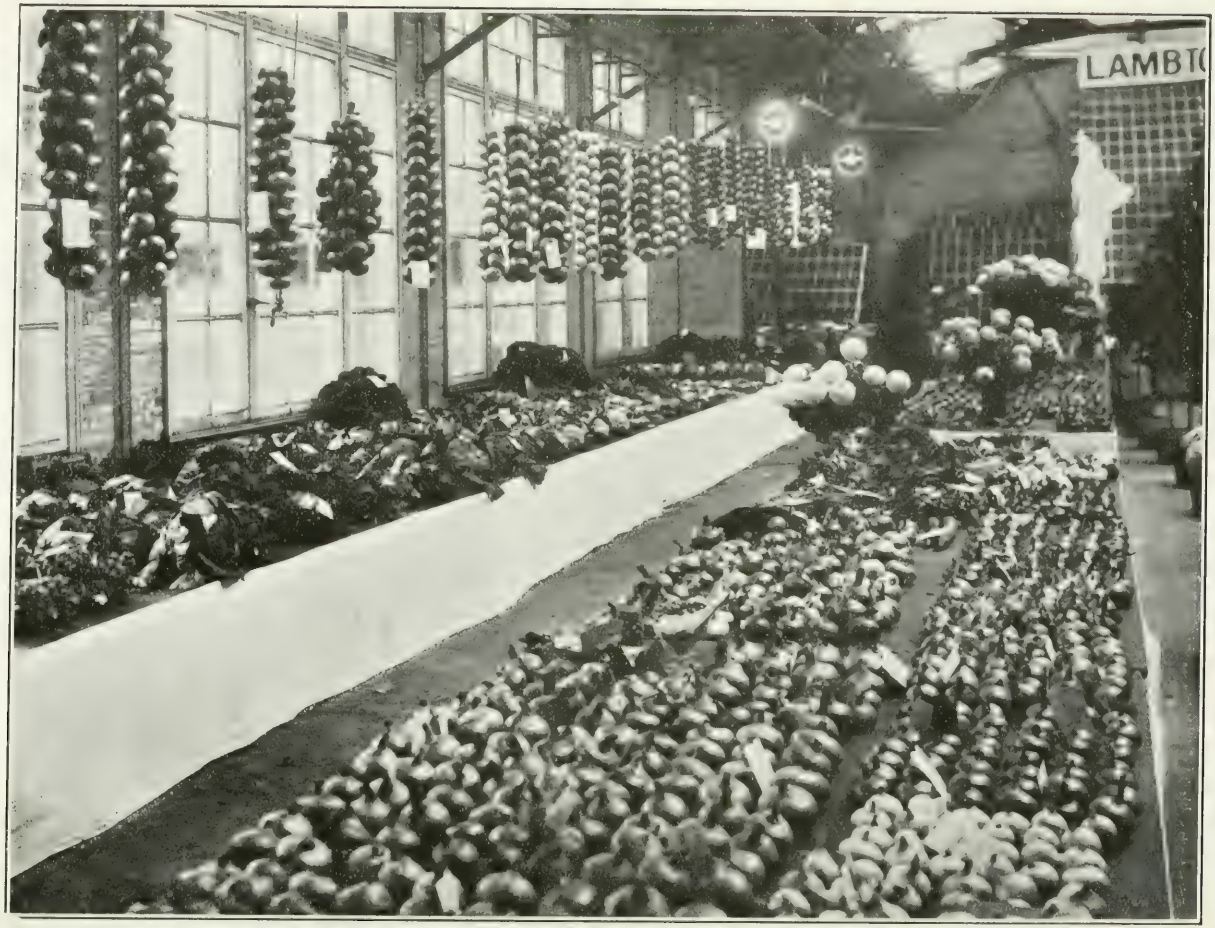


Vegetable Exhibit, Ontario Horticultural Exhibition.

Ontario Vegetable Growers' Association

EIGHTH ANNUAL CONVENTION.

The eighth annual convention of the Ontario Vegetable Growers' Association was held in the Canadian Foresters' Building, Toronto, on Wednesday, November 13th, 1912. The increasing interest shown in the work of this organization was visible in the largest attendance of delegates in the history of the Association.

PRESIDENT'S ADDRESS.

T. Delworth, Weston.

I am pleased to see so large a number of delegates present at this first session of the eighth annual convention of the Ontario Vegetable Growers' Association, and I trust that our deliberations to-day will be as pleasant and profitable as our previous ones have been.

In connection with our work during 1912, we made strong efforts to obtain a proper legal standard for the weight per bushel and bag of potatoes, and other vegetables and roots. You will remember that this matter was discussed at our 1911 Convention, and during the last Session of Parliament a deputation from this Association waited on the Hon. Geo. E. Foster, Minister of Trade and Commerce, at Ottawa, and urged upon him the necessity for this measure. He later in the Session presented a Bill to the House in answer to our request, dealing with this matter. I hold in my hand a copy of the Bill, and will read the clause dealing with the weights of vegetables:

"Clause 337.—A bushel of any article mentioned in this sub-section shall mean, unless a bushel by measure is specially agreed upon, that number of Dominion standard pounds of such article, which is shown in this sub-section opposite the name of such article, viz.:

Artichokes	56 lbs.	Parsnips	45 lbs.
Beets	50 lbs.	Potatoes	60 lbs.
Carrots	50 lbs.	Turnips	50 lbs.
Onions	50 lbs.		

"Sub-Sec. 2.—A bag of any article mentioned in this sub-section shall mean, unless a bag by measure is specially agreed upon, that number of Dominion standard pounds of such article which is shown in sub-section opposite the name of such article, viz.:

Artichokes	75 lbs.	Parsnips	60 lbs.
Beets	70 lbs.	Potatoes	80 lbs.
Carrots	70 lbs.	Turnips	70 lbs.
Onions	75 lbs.		

Owing to a difference of opinion that developed in the House, as to the proper weight per bushel and bag of potatoes, the Bill was withdrawn before reaching its third reading, but I have been assured that it is the intention of the Minister to take the matter up again at the next session of the House.

Well arranged Exhibit.

When we consider the thousands of bags of potatoes that are sold in Toronto alone, simply by the bag, with no law regulating the quantity that bag shall contain, we realize something of the need for this legislation.

Dealing with our experiments in seed growing in Northern Ontario, the work with Early Ohio potatoes has been most successful, and we received from the neighborhood of Thornloe and New Liskeard about four hundred bags of excellent clean tubers, free from rot and scab. These were offered the growers of the Province for seed purposes through the Secretaries of the local branches at $1.75 per bag, and I am pleased that the demand again exceeds the supply.

The growing of seed peas in Northern Ontario was taken up by the Association this year. For the first time a quantity of seed of the "Gradus" variety, one of the most popular of our garden peas, was secured from Germany and placed with several farmers in the neighborhood of Thornloe, New Liskeard and Matheson. Unfortunately, a backward spring, followed by a most exceptionally cold wet season, interfered somewhat with the success of this experiment, but, in spite of this, we have a crop of thirty bushels of very nice stock, samples of which we have here for your inspection. I hope this work will be continued another year, as I am fully confident of its ultimate success.

Field Crop Competitions for Garden Vegetables.

This matter will be dealt with by Mr. Raynor more fully later in the day. It is an entirely new line of work, for which, I am pleased to say, $800 were made available this past season, the work being conducted and managed by the Executive of your Association.

With a view to encouraging the growth of improved varieties and better methods of cultivation, prizes were offered for quarter-acre plots of celery, onions, and tomatoes. This work was somewhat in the nature of an experiment this year, yet it proved most successful, and, should funds be available next season, as I confidently hope they will, I believe the number of entries will be at least trebled. This matter will be dealt with more fully by other speakers during the day.

Distribution of seed was another matter engaging the attention of your directors this year. A representative of one of the largest seed firms in Great Britain, Carter and Co., London, Eng., waited upon your Executive in February last, offering to supply us free of charge with a number of packages of seed of garden vegetables and field roots, for the purpose of introducing what were claimed to be some improved strains of these vegetables, the understanding being that we would distribute them to the vegetable growers throughout the Province and report results. This was done, and a report of the work will be read here to-day.

A quantity of seed was also received from the Ontario Seed Co. for a similar purpose, but, unfortunately, it arrived too late in the season for distribution. Now, while I would deprecate anything in the nature of allowing our Association to be used for advertising purposes, still we are all looking for good seed, and I may safely say that if any reliable seed firm will come forward in this way, we shall be delighted to assist in the introduction and distribution of improved varieties of vegetables.

As for our work as vegetable growers this year, the season has been one of worry and anxiety; we had a wet backward spring, and a very dry June; and it was very cool and wet for the rest of the season. Induced probably by climatic conditions, blights on vegetable growths have been unusually prevalent. The worst of those appears to be the late blight or rot of potatoes. This disease has caused great damage in some parts of the Province this fall.

A good vegetable grower, like a good general of an army, must always have an alternative plan of campaign, in fact a number of them. He must also in all cases be an optimist, and so when a late frost cuts off his tender vegetables in early summer he ploughs the ground again and plants cabbage, hoping that Providence will send a large flock of sparrows at just the right time to catch the green caterpillar. He is also something of a philosopher, and when heavy and continuous rains in midsummer cause his tomatoes to split and crack and so become worthless, he hopes that, perhaps, the rain will do good to the cauliflower patch.

The high cost of living in some of our large cities is at present engaging the attention of a great many of our leading thinkers and business men.

As producers of food-stuffs, we should have something to say. We find a great diversity of opinion, some saying that the middleman is getting more than his share. A large share of the blame, however, rests with the consumers themselves. Many years ago people laid in supplies of onions, etc., from the producers direct; consequently, only one delivery was made and they purchased them cheaper. How

Celery.

are they bought to-day? The grocer or butcher calls at the house and receives an order. Vegetables are bought in quarter peck portions. Go into our grocery stores and ask the price of apples, and you will be told the price per small measure. Carrots, parsnips, and everything are sold by the small measure. These kinds of orders are delivered, and the bill sent in at the end of the month is drawn up to cover the expense of delivering and handling these small quantities.

As long as the consumer demands his goods in this way, he has to pay for them. I doubt whether our middlemen, under the present system of doing business, are receiving any more than the legitimate profits they should derive. It rests with the purchaser to reduce the cost of handling between the producer, the middleman, and himself. This will lower the cost of living.

Dealing with our side, I find there has been no material advance in the price I have received for vegetables in the last ten years, taking one year with another. True, there is an advance as compared with 15 or 16 years ago in everything, but in the last ten years I find no material advance in the price we are receiving whole-

sale for our goods. The high cost of living, so far as our produce is concerned, nas all, or nearly all, been incurred by the unnecessary extra handling after it leaves the producer.

In a land of abundant harvests such as ours troubles due to weather conditions have never been disastrous, and, notwithstanding these drawbacks, I believe the vegetable growers of the Province have enjoyed a fairly prosperous year, and many are already planning larger and more extensive campaigns for next year's operations.

W. J. KERR: Regarding the correct weight of a bag of potatoes, I had a discussion with a member of the House of Commons on this subject, and he was very emphatic in the statement that there was an Act at present in force that made the legal weight of a bag of potatoes is 90 lbs. If an Act is in force making the legal

Thos. Laxton Garden Pea.

weight 90 lbs., it is not fair to householders to make them accept 80 lbs., even though they are willing to do so, as very few householders take the trouble to weigh their purchases.

Our President blames the high cost of living on the householders themselves. He is right in this respect. We had an object lesson in our town last year. Cauliflower and cabbage at that time were a poor crop and high-priced, and we could not get enough to supply the demand. The crop was not to be compared with that of this year, which sold for much less money. One dealer told me that he bought two dozen cabbages on a Saturday and only sold four of them, and that at 5c. apiece. Last year you could put one in your pocket that you paid 10c. for. It all shows that when goods are cheap, you do not want them; when they are high priced you do.

The householders can rectify that difficulty themselves by buying good articles when they get them cheap, and letting the poor stuff alone.

THE PRESIDENT: It is unfortunate there is such ignorance on this question of weight for a bag of potatoes. It is a great injustice that there is no Dominion Statute governing this. In the Province of Quebec they have a law fixing the weight at 80 lbs. In this Province the only regulation fixing the weight of a bag of potatoes are municipal by-laws, which are in force in some corporations and not in others.

In this city we have no municipal act fixing the weight. About two years ago our commission merchants started sending out 80 lb. bags, but discontinued it in anticipation of the Federal Act. As long as there is no act compelling them to do right, they can do as they please. Our commission houses are sending out hundreds of bags of potatoes in 75 lb. bags, and hucksters are delivering these to the consumer, who supposes that he is getting 90 lbs. There is no law to say that he shall, unless he stipulates when buying the potatoes there must be 90 lbs. in the bag. There is need for legislation which protects the honest man from dishonest and unfair competition.

THE PRESIDENT.—I received the following letter from Mr. O'Hara, Deputy Minister of Trade and Commerce:

"May 6th, 1912.

"I beg to enclose herewith copy of Bill No. 78, which was introduced at the last session of Parliament by Mr. Foster, but, on the second reading, clauses 8, 9 and 10 were withdrawn, in view of so many varying opinions respecting the weight of a bushel and bag of potatoes, and also of a barrel of potatoes.

"It is the Minister's intention, however, to bring the matter up next session, and he would be glad to have any expressions of opinion from yourself and others, which may be taken into consideration, when it is hoped a bill will be introduced again next session. The Minister would also be glad to have any suggestions on any other parts of the Bill as formerly introduced."

I replied to this as follows:

"May 25th, 1912.

"Your favor of the 6th received enclosing copy of Bill 78 *re* weight of potatoes and other vegetables and roots. Our Association fully appreciate the Minister's efforts in this matter, and will be most happy to render any assistance in our power.

"Dealing with the weight of a bushel of potatoes, it seems to me that when a bushel consists of eight Imperial gallons, an actual test, there is not much room for difference of opinion as to the weight. Sixty pounds is near enough for all practical purposes.

"With the bag or barrel we have a different proposition. We have then to decide on the best size of commercial packages.

"Now as far as the Ontario Vegetable Growers' Association is concerned, so long as we have a legal standard to which all who offer potatoes for sale must conform, what that standard should be is very largely a matter of convenience, and while I think the weights proposed in the Bill presented by the Hon. the Minister of Trade and Commerce are the best that could be selected, taking all things into consideration, still if any valid objection can be made to them, it ought not to be difficult to arrive at a solution of the question so long as we recognize the need for a legal standard for the whole Dominion, fixed by Act of Parliament.

"If in some way those who are interested in the Bill could meet and discuss the matters, I am sure a standard agreeable to all parties could be found.

"Would it be out of place for me to suggest that the Minister call a conference of representatives of the organizations affected, say the vegetable growers of Ontario and Quebec, the Canadian Retail Merchants' Association, and the Produce Dealers' Association, together with any others the members may wish?

"It appears to me that the legislation proposed is so manifestly in the interests of producer, dealer and consumer alike that we ought to be able to arrive at an agreement."

I received the following reply to above letter:

"May 27th, 1912.

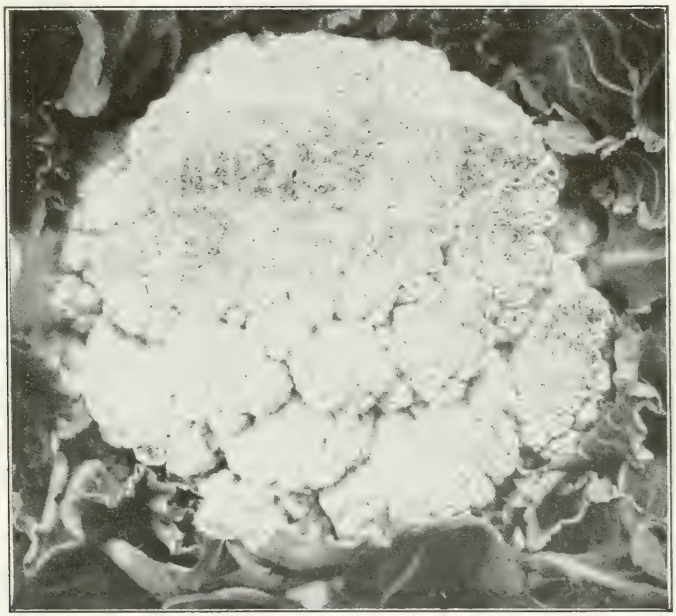
"I beg to acknowledge receipt of your letter of May 25th, for which accept my thanks. I shall also at the first opportunity place the matter before the attention of the Minister.

"I have the honor to be

"(Sgd.) F. G. O'HARA."

There the matter rests as far as we are concerned. There has been nothing else done in the matter, but it would not be out of place to write the Minister again and find out whether the conference asked for might be arranged.

J. LOCKIE WILSON: The only way to get this kind of legislation or any kind is to keep following it up. The letter sent by the President to Mr. O'Hara is an excellent one, and covered the ground very fully. The Ministers have many



Cauliflower.

matters continually cropping up, which take up much of their time, and I would suggest that our Association continue the good work begun, and urge the Minister of Trade and Commerce, Hon. Mr. Foster, and the Government at Ottawa to enact this legislation.

You all know what an enormous amount of money the Dominion and Provincial Governments are spending in order to encourage the farmers to raise more stuff. The cry is "Increase production." This cry should cease for a while and the attention of Governments be turned in the direction of improving the transportation and marketing facilities for those who till the soil. People in this city complain that farmers and vegetable growers are practically reaping all the profits, and getting rich on account of the enormous prices that are being charged to the consumer, while thousands of barrels of apples are lying rotting on the ground in Ontario to-day. It would not pay the farmer to hire help to pick them, purchase barrels and pack them, and pay the heavy cost of freight and commission to get them marketed.

REPORT OF THE SECRETARY-TREASURER.

J. Lockie Wilson.

Each succeeding year shows marked progress in the work of your splendid organization, and excellent results are being accomplished in every line undertaken. In spite of the fact that weather conditions were not very favorable in 1912, germination being greatly retarded by the cold wet weather in spring and summer, crops have been bountiful and prices were on the whole satisfactory.

For the first time in the history of this organization we have inaugurated Field Crop Competitions, which were taken up with energy and skill by our branches in the different sections. The Province was divided into four districts and branches were allowed to compete with three varieties of crops—celery, tomatoes and onions. The districts were as follows: (1) Ottawa, Kingston, Picton, and Belleville. (2) Toronto, Dunnville and Simcoe. (3) London, St. Thomas, Aylmer West, Woodstock and Brantford. (4) Sarnia, Blackwell, Stratford, Ojibwa and Tecumseh.

Keeping down the weeds.

The plots entered were required to be not less than a quarter of an acre. An entry fee of one dollar was charged for each crop, and not less than ten or more than thirty entries were accepted from each Branch. Prizes were as follows: First $25; Second $20; Third $15; Fourth $10; making a total of $840 for the three field crops in the four divisions. The prize winners were also eligible to enter exhibits at the Canadian National and Central Canada Exhibitions. At the former the following prizes were offered for each of the three crops mentioned: $10, $8, $6, $4, $3, $2, $1, or a total of $102. At the Central Canada the prizes were $18, $15, $9, $6, $3, a total of $153. Onions and tomatoes were exhibited in 11 quart baskets and celery in neat crates 22 x 18 x 12 inches.

A number of the baskets of tomatoes sent to Ottawa were in bad condition owing to the long rail transportation. Many of them had begun to decay and were badly bruised. A mistake was also made in the packing of the celery. This was in some cases shipped in practically air tight boxes instead of being set on end in slatted crates with provision made for circulation of air. In consequence, the contents of several of the boxes were mouldy, and had commenced to rot when

opened for the inspection of the Judge. I was there when the boxes were opened, and I know whereof I speak. I would suggest in future, for these exhibits from field crop competitions, that if the Directors of the Western Fair at London would offer prizes as is now being done by the Canadian National and the Central Canada Exhibitions, the Province should be divided into three districts, Eastern, Central and Western. This would do away with the long carriage by rail and would enable the competitors to place their products on exhibit in better shape than can now be done. In thinking this matter over carefully in this, our initial year, seeing the manner in which the Express Companies handle our stuff, I am quite convinced that the shipping of tomatoes, such a perishable produce, from Western Canada down to Ottawa or even to Toronto is costly, until such time as we can get our Express Companies to handle them in a careful way. This is a matter for your consideration.

To show the extent of the influence that our Association has brought to bear on the Dominion and Provincial Governments, as well as on the Directors of our leading Fairs and Exhibitions, I have gone over the prize lists of the Canadian National and Central Canada Exhibitions and the Western Fair, and I find that this year there was offered in prize money for garden products alone, not including flowers, no less a sum than $2,500.00. Never before in the history of vegetable growing has such a large amount been offered in prize money in one year. This should certainly prove an encouragement to the men engaged in the production of garden products.

At the several hundred local fairs held in Ontario, in nearly every section the improvement in the quality of roots and vegetables shown has been marked indeed, and there has also been an enormous increase in the number of exhibits. A year ago at the Canadian National Exhibition, vegetable exhibits were crowded out of the Horticultural Building and relegated to a tent. This year I was able to arrange to have the prize winning products from the crop competitions placed at the front entrance of the new Government Building, and the general exhibit was given plenty of space in the Horticultural Hall.

In addition to these exhibits a grant was given to the Branches at Toronto, Ottawa and London to assist in making a display of vegetables at the Canadian National and Central Canada Exhibitions and the Western Fair. At Toronto the exhibit was displayed on a large pyramid immediately under the dome of the new Government Building in connection with the grain exhibit made by the agricultural societies of Ontario and proved a great attraction to the many thousands who passed through this building. The Ottawa exhibit was on a pyramid by itself, and was a striking example of the zeal and enterprise of the vegetable growers in the vicinity of the capital city of this Dominion. The display at London was also a most creditable one and all three proved a splendid advertisement of the quality and extent of the vegetable crops grown in this Province.

The following are the names of the judges selected for the different districts in the field crop competition: W. J. Kerr, Woodroffe; James Dandridge, Humber Bay; A. Sanderson, Byron; Chas. H. Weaver, Dunnville. The general opinion received by me was that they gave entire satisfaction. At Toronto the exhibits were judged by Prof. MacLellan, O.A.C., Guelph, and at Ottawa by Mr. Wright.

Our Association is continuing its experiments in New Ontario as to the possibility of that section growing seed peas and potatoes for use in the older parts of the Province. We are under obligation to Mr. L. H. Newman, Secretary of the Canadian Seed Growers' Association, for arranging for the purchase in Germany of a quantity of the Gradus variety of peas for seed purposes. This was distributed

among the farmers in Northern Ontario and although the results were not very encouraging, this is chiefly due to the cold weather that prevailed and the lack of proper drainage of the soil.

The potato experiments were carried on by farmers in New Ontario, the Early Ohio being the variety selected. Here, again, the heavy rains interfered with seeding and growth, and also the tops of some of the crops received a severe setting back owing to frosts on two occasions. Stem rot and stem blight were also prevalent and the Colorado beetle is now beginning to be troublesome. These pests follow the farmer wherever he goes. If he went up to the North Pole, he would soon find them following in his footsteps. In spite of all these drawbacks, the results were good and would have been better had the land been underdrained. Drainage is an essential to the growth of good crops in New Ontario as elsewhere. This, in the Northland's wooded country, could be accomplished cheaply without purchasing tiles by using small trees which are of little use for other purposes. Three

First Prize Field of Onions, Ottawa Branch O. V. G. A.
Yield, 1,000 bushels per acre. G. Reiley, Aylmer.

would be sufficient, two on the sides and one on top, and would, I am sure, prove satisfactory for some time to come.

The extremely wet season in 1912 has made more apparent than ever the absolute necessity of a thorough system of drainage in the fields of our vegetable growers and those of nearly every farmer in Ontario. Owing to the scarcity and high cost of labor it has become almost impossible for our farmers and vegetable growers to carry on this necessary work.

The price of a ditching machine runs from $2,000 to $5,000 at the place of manufacture across the line. When freight and duty are added amounting to several hundred dollars on each machine, Ontario farmers are seriously handicapped in competition with those in the United States. None of these machines, I am informed, are manufactured in Canada, so that by placing them on the free list no Canadian industry would be injured. This is a matter, I think, that might well be taken up by farmers and Vegetable Growers' Associations in this country. Of

course, a machine would have to be purchased in a co-operative way and could be utilized by a number of farmers in a township.

Your executive have arranged with Mr. J. W. Rush, of Humber Bay, to store the seed potatoes from New Ontario, totalling about 100 bags, and ship them out when required. Owing to the large crop, the executive have reduced the price to members from $2 to $1.75 per bag, as the latter figure is sufficient to cover the cost of growing, transportation and storage. A resolution was passed at our Directors' meeting last fall, fixing the price at $2. We pay $1.25 per bag to the grower; we have to supply bags, pay freight down here, pay for storage, so that as a matter of fact, it is not a money-making concern for the institution at all, but simply an endeavor to get good seed as reasonable as possible for our members.

We are indebted to the firm of Jas Carter & Co., London, Eng., for a large quantity of seed of the following varieties of vegetables and roots which were received last spring: onions, cauliflower, beans, celery, carrots, brussel sprouts, mangels, turnips—several varieties of each kind—and these seeds, amounting in value to nearly $300, were distributed among our Branches, District Agricultural Representatives and Experimental Farms at Ottawa. Extracts from reports on the tests with these seeds are given below. They will not, of course, be conclusive, owing to the peculiar weather conditions of 1912, but will serve as a guide for experiments in future years. One result of the abnormal year has been a large per cent. of thick necks in the onion crop in many sections of the Province.

St. Thomas: Membership 187. Co-operative buying and the holding of monthly meetings have been the principal lines of activity during the year.

Woodstock: Held an annual exhibition in connection with the Horticultural Society.

Simcoe: A new Branch with a membership of 33. Held seven meetings. Increased interest is being shown. Expect another year to take part in the Field Crop Competition. Made an attractive display at Simcoe Fair.

Kingston: Have been endeavoring to work along co-operative lines. Have been experimenting with different varieties of tomatoes, celery, and cabbage, which will be reported on later.

Brantford: Substantially increased membership. Meetings held every two weeks and have laid the foundations of co-operative buying, especially in seeds. Over 100 per cent. above expenses saved by purchasing in Germany, and seed from that country has proved satisfactory in every case. This is the first order to a foreign country, but they intend to develop this largely in coming year. Increased membership as a result of this purchase of seeds.

Aylmer: Organized in 1912. A number of meetings have been held. This winter a series of lectures dealing particularly with the canning-house crops will be given. Through a purchasing agent arrangements were made for procuring supplies.

Tecumseh: Membership of 46. Several members entered the Field Crop Competition. Forty-two dollars were distributed in prizes among the exhibitors. The County and Township Councils made a grant to the Branch to encourage the educational work they are carrying on. (I wish to say that where there is a Branch of the Ontario Vegetable Association doing good work, or a Branch of any Farmers' Association, they should have no trouble in getting a grant from their Municipalities to encourage their work. The Ontario Vegetable Growers' Association is receiving recognition in every Municipality where work is being properly done, and it is up to you to make it a success, and get assistance that is rightly due you.)

REPORTS FROM BRANCHES, ETC., ON CARTERS' SEEDS.

Branches.	Celery.	Beans.	Carrots.	Brussels Sprouts.	Cauliflower.	Onions.	Remarks.
STRATFORD	Seeds received too late for good test.	Very good	Good	Seeds received too late for good test.	Good		Seeds received too late for best results.
AYLMER	Did not germinate well, but fault was with soil	Very satisfactory	Very satisfactory	Very satisfactory	Satisfactory		
LONDON		Good				Did not butt up well	Seeds received too late for best results. Germination satisfactory
LEAMINGTON	Very successful	Very successful	Very successful	Very successful	Very successful	Very successful	
SARNIA		Very prolific, but not suited to this district	Fairly good				Seeds all good and germinated well.
BRANTFORD	Poor	Good crop	Good	Good	Good	All thick necks	Poor results may be due to late sowing.
TORONTO	Seed received too late. Blight attacked crop	Early and good crop. A little too flat for our market	Very good	Too late	Good	Failed to bottom up	Germination of all seed exceptionally good.
OJIBWA							Seeds all gave best results.
WOODSTOCK	Excellent	Very fine	Very fine		Good	Good	All well pleased with seeds.
ST. THOMAS	Seed too late	Extra good crop.	Extra good crop.	Seed too late	Very fair	Seed too late	All growers pleased with the results.
TECUMSEH		Poor	Good crop		Poor	Good crop	
PICTON		Germinated well, but did not make vigorous growth.	Exceptionally good, uniform size and shape. Excellent for table	Grew well, but did not mature	Produced heads not distinguishable from Henderson's Snowball	Grew well, but large percentage of thick necks	

SIMCOE. Germinating value of all seeds unusually good. Plant growth mostly excellent. Beans and carrots very fine. Cauliflower late in heading.

OTTAWA. Owing to seeds being received late no proper comparisons can be made with the other seeds. Germination was good, and there is every prospect of a big yield. The seed compared very favorably with the best seed sown from other sources.

OTTAWA: The Ottawa Branch of the Ontario Vegetable Growers' Association. "Resume of work for 1912: We bought in Germany part of our seed supply this year, and while the cost was, on the average, only about half the price we had to pay to Canadian and American seed dealers, the quality of the seed was equal, if not superior, to the best we ever planted before, our chief complaint being that, having sown the seed about the same thickness we usually sow such varieties, we had far too thick a growth, one of our members saying that " Far more seed grew than what he had sown."

We also tested seed from Carter, of London, and found the germination first class, and the crop of many lines to be very satisfactory, but the onions from Carter's seed have not matured as well as those from American grown seed. I may say that this is the general consensus of reports. Onions bought from Carter Seed Co. have not grown so very well, whether it is on account of the season or not we cannot say, but one would suppose in a year like the present, when we have had rain nearly every day the seed would have done well. We tested seed from both our local and from several American seedsmen, and found one of our local men provided as good quality in most lines as the best we got from the United States.

We have been permitted to hold our winter meetings in the Public Library in the city without paying any rental, thus saving our financial resources for other purposes. We have visited eleven of our members' gardens during the summer, where we were most hospitably entertained, and were taught many useful lessons.

We also visited the Central Experimental Farm, where we were shown many very interesting and instructive experiments. This institution has been for many years a source of much assistance to us. Our excursion to Macdonald College, Que., was also very interesting and instructive as well as netting our Branch a nice little cash surplus.

We were granted by surrounding municipalities the total sum of $115 to assist us in our work. We paid for field crop competitions prizes to the amount of $84; in special prizes at the Dominion Exhibition $46 and at Aylmer, Quebec, Exhibition $25. Our membership is more than 55 per cent. higher than last year, thus making a new record. We have the largest cash balance we ever had."

The co-operative idea of purchasing seeds and supplies is gaining ground each year. The Brantford Branch during 1912 saved about 100 per cent. over and above all expenses by purchasing their seeds direct from Germany, and other branches are saving their members large amounts on seeds and sundries required in their year's operations. The membership of the Branches continues to grow, and there is noticeable increase in enthusiasm among the vegetable growers in the different districts. Speakers have been sent to a number of Branches during the year, and have done much good in creating further interest in the excellent work which is being done by the members in those sections.

During the year the Executive held sixteen meetings and the Directors three.

To the officers and members of the Ontario Vegetable Growers' Association, to whose efforts in a large measure is due the success of this organization, I wish to extend my hearty thanks for the many kindnesses shown to me during the year. Among us the greatest harmony and good will exist, and our united efforts will continue to make this Association, as it now is, one of the best of its kind on this Continent.

THE PRESIDENT: We are all indebted to the Secretary for his very able address. During the year, we had a series of experiments to determine the best source whence to procure onion seed for sowing in this Province, and the result was that English-

grown seed did not do as well as others. We got seed from three or four different places, some from England, France and California, some from Ontario, and the English seed was at the bottom of the list. English-grown onion seed requires a longer season. At the end of September they do not ripen properly or quickly enough. This appears in detail in our reports of 1909 and 1910.

W. J. KERR: We had some seeds that had been grown near Montreal that gave us excellent results. Onions were small there, much smaller than here because seed from Ontario dealers did not germinate easily. When in London, I was glad to notice they were having success there with their seed. I purchased seed from a number of dealers and growers, not only in this country but in Europe, and the most satisfactory onion seed I had this year, as far as germination was concerned, came from Northern California. It was sent free for a test, and gave us the better germination and a better crop than anything we had.

Vegetable Exhibit, Bracebridge Fair.

A MEMBER: I happen to be one of the lucky ones who got the $25 prize. The seed I sowed was purchased from Mr. McInnes. When Mr. Kerr was up and saw my patch of onions, he said, "You have a pretty good variety of seed." He found only three red onions in the patch. If I had known he was coming, I would have taken them out. Mr. McInnes grew that seed in London. I grew about 150 bushels from one lb of seed, and bought 22½ bushels to plant again next year. They are a very fine onion, and if we patronized our own seed men and used home grown seed, we would have better results. I had very few thick necks.

A MEMBER: I am only a small onion grower, but I would like to find out the reason of thick necks. I think it is caused by poor soil. In Woodstock I have a garden 56 x 198 feet, and was very successful in growing onions this year. I sowed five kinds and got five first prizes. The seed came from Leuty & Ferguson, Montreal. I had two rows 45 feet long that weighed over 12 lbs. I also had twelve of another kind that weighed 19 lbs. My neighbor's onions had many thick necks, while I had very few, which might be due to the kind of land. Speaking of the Old Country, we sow our seed too late in the spring. It is always the 1st of

Good Arrangement.

May before we begin. I sowed seed in March, and transplanted them, and got the best results that way. I had a number of our members of the Woodstock Horticultural Society call to see me, and they claimed they never saw so much grown in so small a piece of ground.

T. G. RAYNOR: I have had some experience with thick necks in the vicinity of Collingwood. A gardener there sowed seven kinds. The majority turned out to be thick necks. It could not be the fault of soil conditions, as it was well fertilized; some of the seed had been grown on his neighbor's ground and all developed thick necks. As near as we could trace it, this man declined to try first-class onion seed, because he could get some $1 a lb. cheaper. We could not trace where that seed came from, but we came to this conclusion that seed grown under certain conditions seems to develop thick necks. Seed from Connecticut and California developed less thick necks than where there was great moisture and a longer season of growth.

THE PRESIDENT: I referred a few minutes ago to a series of experiments conducted to find the best source of supply of onion seed. We conducted the series prior to sowing onions. The seed was secured and sowed as early in the spring as the ground would permit. We made another sowing ten days later, and another about ten days later again. The results were that the first sowing gave me an excellent crop. The second had a percentage of thick necks in them, and the third were all thick necks. This experiment was conducted by myself, the results were tabulated and are in the report of 1909. They were conducted in twelve or fourteen different gardens. The early sowing gave less thick necks than the late sowing in almost all cases. The question of thick necks in onions may result from a variety of causes. The places where you get your seed from makes a great difference, because you want for this climate seed that will mature rapidly.

J. W. RUSH: I had something of the same experience this year, and the kind of soil made a great deal of difference. In some ground I had about three times the number of thick necks that I had last season. The beginning of May is the best time to sow onions, but sometimes the weather conditions modify this. This year my son moved to Georgetown, and asked me to send him some onion seed. I told him it was too late to sow, but sent him eight lbs. He sowed that, and one of his neighbors sowed an acre three days after my son, during the latter part of May, which was altogether too late. The thick necks were as big as your arm. Seedsmen are sometimes blamed for that, but the seed I sent him I got from one man and what I sent his neighbor I purchased from a seedsman at Collingwood. I blame late sowing for most of the thick necks.

WM. VROMAN: Of the seed sent me for distribution, some was sown on high, dry soil, and the rest on muddy ground. The first was good; the last, sown a week or ten days after, almost useless.

THE PRESIDENT: The conclusion is that the date of sowing very likely causes thick necks in onions, but you must remember that this is not the only cause, as we have quite good evidence to the contrary. The place, country, or climatic conditions under which that seed is grown also affects the product. Our experiments conducted over two years showed two definite causes for thick necks. One was climatic conditions, and the second, date of sowing. These are the main causes.

W. J. KERR: There is another point to which I would like to draw your attention. In our district and other sections of the Province we have had a good deal of difficulty on account of the heavy rainfall this season. Some years ago I had some experience with the digging of tile drains by machinery. A machine was

bought in the States at a very high price, and the vendors charged so much a rod for putting in a drain about 100 rods long. Had we been able to get one of these machines, we would not have had such difficulty with the wet weather this season. We have, therefore, drawn up a resolution which we intend to present for your consideration, and if you see fit to have it passed and authorized, we will submit it to the Government.

Moved by W. J. Kerr, Ottawa, seconded by W. J. Robb, St. Thomas: "That whereas drainage of our farms is one of the most important lines of work required to be done in order to secure the best results from our labors, and with the proper drainage of our farms the productive values of same would be increased many millions of dollars, and in view of the high cost and scarcity of labor, it is of vital necessity that we get such necessary work performed in as economical a manner as possible. Within recent years there has been invented a traction tile draining machine which has, to an enormous extent, lessened the cost of draining. These machines are not manufactured in Canada, and the duty on them amounting to

Interested.

several hundred dollars on each machine renders their importation almost prohibitive. We would, therefore, respectfully request the Dominion Government to remove the duty on these machines and such others required by us until such time as they are manufactured in Canada, and that a copy of this resolution be forwarded by our secretary to the Right Honorable R. L. Borden and the Honorable Messrs. White and Borden." Carried.

John W. Hyatt: We have been doing some draining work in our part of the Province—in Prince Edward County. Draining is one of the most essential things it is possible for us to conceive, and the time has come when we must take from our soil increased production. We can no longer afford to pay a man $2 for a day's work if we only get back $2 worth of production. We are the losers under those conditions. We must get at least $2.50. Mr. MacVannel, our district agricultural representative, arranged for the survey of the lands and plans for the draining for us, and your representative can do that for you; it does not cost you a cent. Then you get your tile, and your machine, and it will dig about 100 rods

a day and reduces the cost materially. It is a great invention. I have a crop off a field this year, which, after deducting expenses, will be worth to me about $700 or $800. This year I am going to put in a million dollar plant there. What I mean by that is it will pay me in my farming operations, if I go at it properly, to lay the pipes, open it up, and when it comes dry for the other departments of the work, I am going to have plenty of water. Down in Prince Edward we believe that what any man can do Prince Edward can do, and I am going to put in a million dollar plant, and if any other man made $5,000 I will try and make $6,000. That is the way we do down there.

J. W. Rush: The motion passed would include bringing in any implement that can be used by the vegetable growers or farmers that is not manufactured

Vegetable Marrows.

here. Would it include the Skinner system of irrigation? I think these should be specified.

The President: Mr. Kerr's motion covered that.

W. J. Kerr: My motion has reference to the importation of any machinery we require that will be of any benefit to us that is not manufactured in this country until such time as it is.

J. J. Davis: If you want to make that cover the Skinner system of irrigation, you would have to change the motion, because there is no machinery attached to the Skinner system—just the material.

The President: In regard to the Skinner system, I am informed by the Williams Machinery Co. that they are prepared to supply those nozzles. I do not know where they are manufactured, but Mr. Williams says they are prepared to supply them. The motion is carried.

A MEMBER: Referring to the remarks made by Mr. Wilson in regard to the fruit question, it seems to me that it is rather inconsistent to go to work and pass cast-iron laws. It is one of the most serious problems confronting the fruit growers to-day. I would move that a resolution be passed asking our Government to find a solution for the great waste throughout the Province in our orchards. In our district they are paying 7 cents a bushel for picking apples, and half the orchards are not picked, as help cannot be secured. It seems to me this waste should not be allowed. There is something radically wrong. If the people in Jamaica can solve the question, we can here in Ontario. We ought to have the same intelligence as they have. I move that our Government be asked to investigate the matter and find a solution.

THE PRESIDENT: The resolution deals solely with apples. I would like to have it comprise other things, and that the Government be requested to find some solution, there being no sufficient market for our products.

The motion carried after discussion.

THE BENEFITS OF CO-OPERATIVE PURCHASING BY OUR ASSOCIATION.

W. J. KERR, OTTAWA.

The subject of co-operation is engaging the attention of very many persons, corporations and nations. The vegetable growers throughout America are forming many co-operative associations. Large corporations and companies are co-operating with each other to lessen the cost of production and teach each other the best and most profitable methods. Nations are co-operating with each other for their mutual protection and welfare. We have had here to-day evidence from some of the members of the benefits of co-operation. Thus we have Great Britain, France, and Russia united in a common bond of friendship as a means of self-protection against the other three nations, Germany, Italy, and Austro-Hungary. We also find the four little Balkan States of Montenegro, Greece, Servia, and Bulgaria, States of such insignificance that we have heard very little about them, banded together in a co-operative pact, and performing feats that have amazed the world.

We read and hear a great deal of late about the advantages of co-operation, and yet we know but a very small part of the benefits derived from such banding together.

The market gardeners of the Ottawa district a few years ago were struggling along in a kind of a way, a few making a little money, and nearly all more or less suspicious of each other, and none of them enjoying life and making the success they might. Our President, Mr. Delworth, appeared on the scene in the spring of 1906 and got a number of them together to explain to them the benefits of co-operation, and through his influence a branch of the Ontario Vegetable Growers' Association was formed at Ottawa, but the spirit of co-operation did not seem to get hold of the members for the first four years, and at the end of that time the branch very nearly went out of existence: but in the winter of 1911 our Association bought a car of berry boxes, baskets, etc., and also bought in Denmark a few seeds as a trial. This venture proved eminently successful, and a saving of about $200 was made for our members in the car of baskets, while the seed purchased

direct from the grower in Denmark cost us only about half what we had been in the habit of paying, and the quality was much superior to anything we had ever had before.

This co-operative purchasing of supplies built up among us a spirit of brotherly love and mutual confidence that has been of untold benefit to us. Our Branch has taken on new life, our members have increased, our finances have grown until, in place of having a deficit at the close of the year, such as we had three years ago, when the Secretary was compelled not only to give his services free, but had to go down into his own pocket for part of the running expenses, we this year paid out the sum of $160.50 in prize money, and will still have a nice little surplus at the end of the year. I consider that the purchase of supplies co-operatively by our Association has been the chief factor in working this wonderful change. True, we had good material to work on, in such men as my friends and fellow-members Messrs. Hull, Trick, Stewart, Carstesen, Mr. Belot, and our esteemed President, Mr. McConnell—all of whom are here to-day—who have been very attentive to our meetings, and have always been ready to assist in anything that stood for the good of the Branch. We have several other members just as valuable as these, and I wish

Seed Testing.

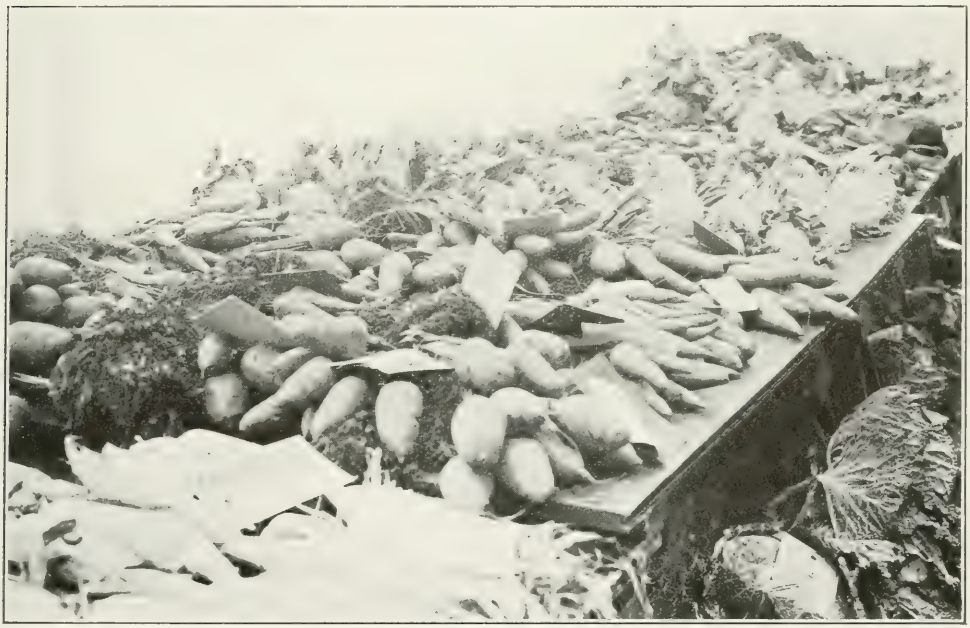
to speak especially of our worthy friend, Mr. Farquharson, who, when we bought the car of baskets and had nearly $100 worth more in the car than we had sold, came forward and put up the money to pay for them till we had them sold some months after, and refused any remuneration for the use of his money. The special exhibit of fruit and vegetables which we put up at the Dominion Exhibition and donated to the Orphans' Homes of our city this year, was also a positive proof of the genuine unselfishness and true co-operative spirit of our members, but yet these same men very nearly made a failure of the organization until we had begun the co-operative purchase of supplies. We have saved many dollars by buying co-operatively, and this is a very important item. Nothing succeeds like success, and the man who is making a financial success of himself can carry his head much higher than if he is not succeeding, and every dollar we save is a help towards success.

Then again, the seeds we have bought, the source of our bread and butter, have been of the very highest quality, and we have been able to produce much better crops from them.

A few years ago we could with difficulty get a delegate to come up to Toronto to attend the conventions and annual meetings, but now we can turn out in force, and if our success continues for a few years, you may expect to see our Branch come up in a body. When so many members come from one Branch, 250 miles

away, you will admit that the Ottawa Branch is becoming a pretty enthusiastic lot of men.

To give you an idea of the financial saving in the cost of the seeds, I will quote you from this season's prices as offered by two of the largest growers of seeds in the world. One quotes Nantes Carrot seed at 30c. per pound; Lettuce at from 25c. to 30c. per pound—that is the leading brand of lettuce—and a few other lines equally low. Another of the largest growers in the world sold us last year Snowball Cauliflower at 62c. an ounce (you know what you pay for these seeds here), Chantenay Carrot at $1.10 per pound, Danish Winter Cabbage at 75c. per pound, instead of $1.50; Glory of Enkhuizen Cabbage at 75c. a pound, Lettuce at from 40c. to 50c. per pound, Moss Curled Parsley at 34c. per pound, Hollow Crown Parsnips at 14c. a pound (dealers across the line quoted $1.00 per pound), and many other lines equally low. True, the seeds bought in the United States



Toronto O. V. G. A. Exhibit.

were not much lower in price than we can buy at home, but we bought from the grower and got fresh goods, pure and true to type, and of high germination. This is much more important, in my opinion, than the cost of seed. We have to go to the States for onions, melons, corn, etc.

I estimate that by co-operative purchase of all our supplies the members of the Ottawa Branch can save in original cost over $1,000, and can make from their extra crop, due to high quality seed, several thousand dollars more on the average each year. Is this not enough to make one enthusiastic over co-operative purchasing of supplies?

But this is not by any means the most important of the benefits to be derived. The spirit of good will and brotherly love engendered by banding together in that way, and working together, has done a great deal to brighten our lives and make life worth living. The unfortunate creature who lives only for the dollars he can

make, and who encases himself in a shell so thick and tough that his fellow-men cannot reach him and stir up in his breast a feeling of brotherly love and delight in serving his fellow man, is to be pitied indeed.

Let us co-operate more in the purchase of supplies and I am sure we will all find it pays, if we pursue the right course, and let us all co-operate in serving each other through the Association, and make of it one of the greatest means of good that our country possesses. It is a fact that the possibilities for good of this banding together are wholly unlimited, and if each one of us does his duty, the Ontario Vegetable Growers' Association will soon become a bright and shining light in the country, spreading more happiness and sunshine than the fondest dreams of the founders of the organization ever hoped for.

Co-operative purchasing of supplies has given our branch such a stimulus that we have been able through our increase in membership and the publicity given us through the Press to get grants this past season of $115.00 from the surrounding municipalities, with which to help us in our field crop competitions, and our special prizes awarded at the local shows and the seed purchased co-operatively by our Association have assisted our members to win much prize money—one of them having won over $200.00.

I strongly urge you to make the garden meetings a part of your summer programmes, and you will find them a wonderful stimulus towards the production of high class goods and heavy crops which will soon bear you rich crops of profits, and, if the same spirit of co-operation and brotherly love is made to dominate your respective branches as has been the case with ours, it will not be long till the Ontario Vegetable Growers' Association will be a force in this Province that will stop at no obstacle in its onward march of progress and good works.

In closing I wish to refer to the good work of our women. The wives and daughters of the members of the Ottawa Branch have certainly done their share to merit the unstinted praise of our Association. I spoke before of the benefits we have derived from the garden meetings we hold every summer. I wish now to say that the success of these meetings is due in no small measure to the noble co-operation of our women who have so cheerfully responded to our wishes and provided the visitors with refreshments coupled with such hearty welcome as makes us all feel at home.

THE BENEFITS OF CO-OPERATIVE PURCHASING.

GEORGE PHILP, PURCHASING AGENT, ST. THOMAS BRANCH.

This is the day of concentration, whether it be applied by the individual or by a number combined together for that purpose. To-day we find the individual specializing or concentrating his energies along some particular line: the retail dealers entering into an agreement for their mutual benefit: manufacturers amalgamating, large corporations having plants located in different localities concentrating the manufacture of their various articles each in a different factory. This is all done with a fixed purpose, viz., a saving in the cost of buying, operation and marketing. The farmer has the work of a number of men concentrated in the work of his binder: the shoe manufacturer has his soling machine to save the work of several cobblers, and the poultry raiser has the incubator to do the work of dozens of

hens, each concentrating in their separate work to save the cost of production. Why should not the members of this Association band together in buying, operating and marketing? While co-operation in production and marketing are just as important as in buying, I shall not deal with these topics here, but in the interests of this Association, I would remind the members of the benefits to be derived from these sources.

Four years ago the St. Thomas Branch of the Ontario Vegetable Growers' Association was formed with a membership of 29: to-day we have nearly 200 members, representing all parts of our county and some from adjoining counties, and the prospects are this number will be greatly increased this coming season.

While this was formed as a branch of the O. V. G. A. it has become strongly a farmers' and fruit growers' as well as a vegetable growers' co-operative society. We have in our locality, as no doubt there are in nearly every agricultural section in this Province, numerous farmers who produce fruit and vegetables to a greater or less extent: these are the very people this branch has found to be its most active and enthusiastic members, progressive, eager for knowledge, and anxious to learn the best in every branch of their business.

Aside from the educational opportunities offered these members by this Association, we have a system of co-operative buying, enabling the members to purchase their supplies at a greatly reduced price. Before this branch was started vegetable growers had to pay the top price for their seeds, fertilizers, Paris green, etc., the fruit growers were at the mercy of the retailers in purchasing their berry boxes, fruit baskets, apple boxes, spraying outfits and all kinds of spraying material; the farmer previously paid the agent's profit on binder twine, wire fencing, seed grain and field and grass seeds. In fact there is no end to the list of articles which members of the different branches of this Association now have the opportunity of purchasing at practically wholesale prices. We have bought and sold different articles of supplies at a price lower than the retailers in this section could obtain them from their wholesale houses; we have prominent retail dealers who have become members of our branch as they realized they could purchase through us cheaper than they could direct from the jobber, and if they can buy through us and sell to outsiders at a fair profit, surely this is evidence our members are getting their supplies at a right price. However, there is strong opposition to our co-operative buying. One would suppose that if we purchased and paid for our supplies lawfully there could be no objection to our transacting a lawful business, but such seems not the case. Some retail dealers claim we have no right to sell cement, sugar, etc., and have notified the firms who sold to us that they would withdraw their patronage if the wholesalers continued supplying us, and these wholesale firms have since refused to fill our orders. Some members who placed their orders early this past season saved five dollars per bushel on alsike clover seed and three dollars and ninety cents on timothy: on field and garden seeds we saved them 30 per cent.; Paris green, ten to fifteen cents per lb., and like amounts on everything we handled. One member told me he saved seven dollars on two barrels of commercial lime sulphur solution by ordering through our Association. I am advising our members to buy their supply of binder twine now for next season's use, and unless the price of the raw material drops between now and March the first, those using twine will be paying three to four cents per lb. more for it than they did this season.

As I stated before, we have in our branch nearly two hundred members, which, possibly, puts us in a little better position to buy in large quantities than some of

School Gardening.

the younger and smaller branches, but if these branches put forth every effort in organizing systematically, canvassing their territory and laying before their neighbors the opportunities and benefits to be derived from becoming members of the Ontario Vegetable Growers' Association, there is no reason why every branch of this Association should not be buying their supplies in large quantities, and in some cases in carload lots. Perhaps we are a favored spot. You know Elgin is a good county, but wherever this Association has a branch formed (and in many sections where there is none) I feel sure the surrounding conditions are just as favorable for a good live branch as they were with us when we started. What we want is more co-operation, and I would like to see every member here go home with the determination that every farmer, fruit grower and vegetable grower in their district and in the surrounding country should know the advantages offered by this Association, and, if possible, enlist them and secure their co-operation.

We have met with a fair share of success in our branch, and our experience may be of interest to other branches in knowing our method of organizing and conducting our educational and co-operative plans.

We hold the election of officers at our annual meeting in December, besides electing the regular officers as prescribed in the Constitution. We divide the adjoining townships in sections, and appoint a committee of two to canvass each district for new members. The regular days for meeting throughout the year are arranged, and a programme committee is appointed whose duty it is to provide some special attraction for each meeting. A purchasing agent is appointed who secures prices on various supplies the members may require the coming season, getting out a price list on same, and I believe this has been a strong drawing card with us. You know when you touch a man's pocketbook you reach his heart. Get out a good list and show it to a prospective member and it appeals to him at once, and in this way you have something for your canvassers to work with. Get your orders for supplies in as early as you can. If I could, I would order not later than March 1st, and endeavor in every way possible to have the goods in the customer's possession before he gets busy with his spring work.

THE PRESIDENT: We did a little co-operative purchasing in Toronto some years ago. I would like Mr. Kerr or Mr. Robb to tell us briefly how they do their collecting. We found when doing our co-operative purchasing, that the Secretary received a requisition stating how many seeds were wanted. This order was made out in bulk and tenders were received on it. When the seeds were shipped, there was some difficulty in collecting bills, and the loss fell on the Association or the Secretary. When we started a branch of the Ontario Vegetable Growers' Association here, we declined to pay anything or handle any money for any of our members. We got firms to make prices, contracts, etc., on the understanding that we would direct our members to buy from them, and they had to get their goods and pay for them themselves. The officers did not handle money for anybody.

W. J. KERR: Our method has been to purchase say a carload of baskets. Two or three of us go to the firm from whom we buy; the goods are shipped to our orders and the baskets distributed from the car and paid for at the car door. So far as seeds are concerned, a list is sent to us of requirements of each member. We send that list with the names to the firms from whom we buy our seeds, pack them up, address, and ship them. They are charged up to my account at the bank, and when the seeds are delivered to customers, they are paid for. I know that seed merchants are in the habit of giving the grower time. This is a great advantage to many people who have not funds ready, but they

always pay well for it. They pay more than 10 per cent. for waiting. We propose this year, as we expect to do a large business, to carry these accounts ourselves. Our Association is strong enough to do this until the 1st of September at an advance of 10 per cent. for goods, so that any who wish to have these accounts made payable the 1st of September, merely notify me to that effect when handing in their statement, and pay us 10 per cent. additional on the cost.

C. W. Baker: We have great success in London. Every man in buying fruit baskets, Paris green, etc., gave his note: the banks collected the amounts: we had no handling of funds, and every man paid up promptly.

The President: I am pleased to have this information, as in this co-operative system there is generally too much work left to the officers, and they oftentimes have to do the work of an ordinary tradesman. If we can find a way of getting over this, it will help co-operation very much.

REPORT ON THE GRADUS PEA.

T. G. Raynor.

While inspecting the potato crop for the Ontario Vegetable Growers' Association, I was requested to report on the Gradus pea purchased by your Executive through Mr. L. H. Newman, of the Canadian Seed Growers' Association and grown in New Ontario.

Mr. Stephenson's Piece.

E. F. Stephenson, New Liskeard, had about an acre and an eighth of this pea on a side hill which allowed the surface water to run off. He had a good stand and good growth but the piece was weedy. The pods, while quite large, were not all well filled. The yield would be about eightfold. Part of the piece was sown more thickly than the rest and promised a better yield. The cold, backward spring had affected the peas, but they were about ready to harvest. The peas were large and should make a good sample if the harvesting weather was satisfactory. A few peas were off type.

Mr. Washington's Piece.

George Washington, Thornloe, had about three quarters of an acre. The peas were sown rather thinly, but the crop promised well. It was on new ground and the pods seemed larger and better filled than Mr. Stephenson's. They may yield eight and a half fold. They were in the green pea stage at the time of my visit.

Mr. Bartlett's Plot.

D. Bartlett, Matheson, tried a plot on new ground. He sowed what he received on about half an acre broadcast. The ground was fairly level so that, besides the peas being poorly covered, they were hurt by the wet weather, and the rabbits had cut off the pods and eaten the vines. Mr. Bartlett will do well if he gets his seed back.

I saw some early lots grown for Messrs. Hogg and Lytle of Mariposa, which were poor or good according to the drainage. Almost invariably the late peas were doing well; in New Ontario they were better than the early kinds. There was a good growth of straw and the pods were filling well.

There is no doubt that New Ontario is a good pea country. The farmers hardly make their land level enough for early peas, which grow none too much straw for harvesting well on a rough surface.

J. Lockie Wilson: I will read reports from Demonstration Farms on experiments with vegetables:

Ottawa Branch Exhibit, Central Canada Exhibition.

A. D. Harkness, Jordan Experiment Station: Reports failure in crops owing to wet weather in the early part of the season, and later on drought caused the experiments not to be a success. However, celery, cauliflower and beans did fairly well and the quality was said to be excellent.

Chas. A. Galbraith, Monteith Demonstration Farm: The report is as follows in reply to a letter sent by me some time ago: The season in Temiskaming this year was far from satisfactory and beyond a very creditable showing in the growing season, the results were disappointing. We did not grow any crops for the

Vegetable Growers' Association, and aside from our crop of potatoes and turnips nothing of interest to our Association need be reported.

This was a decidedly poor year for potatoes in this district. The weather was cold and backward in the beginning, and throughout the entire season there was a dearth of sunshine and a very copious evaporation, which with our poorly drained soil in recently broken areas, proved disastrous to growth and maturity.

On a complete fertilizer experiment which we conducted, the results were fairly representative of the conditions which prevailed in the vicinity of Monteith. The tops made an excellent showing during July and early August; no beetles made their appearance and no spraying was necessary at any time; the only fungus disease that was present was *Fusarium Osysporum,* or stem blight, and this, not being contagious, was not treated. Beyond being nipped at intervals in the early part of the season, the crop escaped the frost until about the 21st of August, when it was frozen off completely. In spite of the fact that the crop was thus killed at the height of the growing season, the yield was 150 bushels to the acre where the conditions were normal. The turnips were sown on the 13th of June, but suffered from the wet weather and lack of sunshine in the early part of the growing season. No flea beetles or aphids attacked the tops at any period of their growth. The cool weather was not so detrimental to the crop, yet it would seem that more sunshine is essential to a proper growth and development than was available for the crop here this year.

On a complete fertilizer experiment, the results might be taken as indicative of the average production in the vicinity of the farm. The best plot produced at the rate of 500 bushels per acre and the best average might be taken as 375 bushels.

In order to appreciate the true significance of the results here enumerated, it must be borne in mind that the Monteith Farm is only three years old, and there are no clearings within a hundred miles of it sufficiently large to influence the season. In the growing of crops at the farm, no provisions are made for pampering or coddling the plants, as is often the case where an attempt is made to produce phenomenal yields. Only average conditions are preserved and the production is indicative only as a demonstration of the possibilities of the district. Vegetable growing belongs to an intensive scheme of farming, and it must be borne in mind that the drainage situation exists here in its crude nativity. Newly broken soil surrounded by forest and slough is far from its maximum of production and no comparison with improved lands in Old Ontario is justifiable or warrantable.

CHAS. A. GALBRAITH.

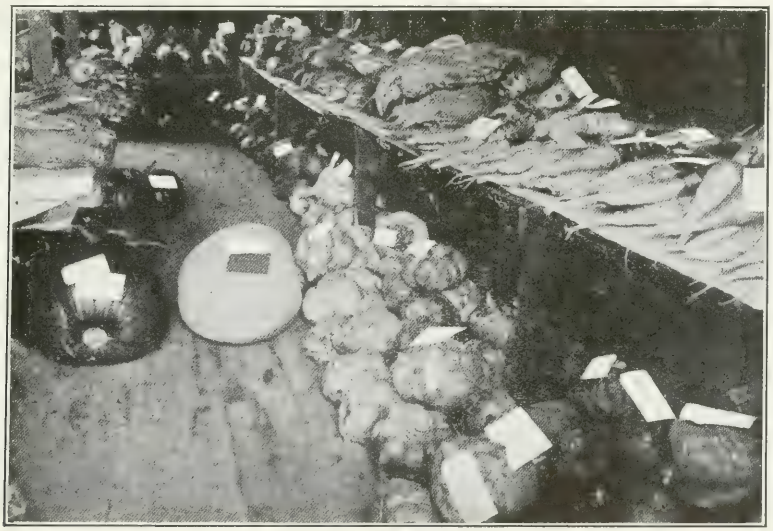
THE TRANSPORTATION PROBLEM AS IT AFFECTS OUR MEMBERS.

E. E. ADAMS, LEAMINGTON.

Before the Christian Era, and even up to the present time, we find in certain parts of Africa and Asia that the caravan is the only means of transportation, camels being the motive power. These are often harnessed in strings of fifty or more at a time, a hair rope connecting the rear of one beast with the head of another. These caravans are regulated by the seasons, the summer and early autumn being avoided owing to the scarcity of water. To western men this method is very primitive when we compare it with what we see around us to-day.

We also find that in early days the poet Virgil said: "Rivers first then the hallowed alders felt." Alder is a heavy wood and not fit for rafts, but to make for the first time a dugout canoe of alder and to secure its flotation would be a triumph of primitive art, and thus the poet's expression represents a great step in the history of the invention of the ship. Dugout canoes have been associated with objects of the stone age amongst the ancient Swiss lake dwellings, and specimens have also been found in the bogs of Ireland. They also have been found in Scotland and in England twenty-five feet below the surface of the ground. Gradually through the centuries we have evolved the magnificent ships of the present day.

Railways had their origin over two hundred years ago in the tramways connected with coal mining in England for the conveyance of coal to the sea. These railways were built of wood, having rails with flanges of wood to hold the cars from running off. The tramway was developed into the railway by the employ-



At Bracebridge.

ment of cast iron flange rails, other rails as we have them to-day have been developed in accord with modern ideas. The first railway appears to have been built in England running from Stockton to Darlington, a distance of 38 miles, in the year 1825. The first engineer was George Stephenson, the inventor. The speed of trains in those days was about 12 to 15 miles per hour. Comparing this with some of our fast trains of the present day, would lead us to think they were somewhat slow in those days. For the information of those of you not directly connected with large shipping, I might say the railways have not improved on that speed of 12 to 15 miles an hour on moving freight. Those of you who have been shipping largely will verify this. We are just as slow in these days as they were at that time regardless of the fact that we think we are somewhat swifter.

But we must not forget that nearly all the good things we have to-day have come down to us from these small and imperfect beginnings. Both on this continent and in Europe there are railways traversing the country east, west, north and south, with lateral lines covering an immense territory, giving service,

both passenger and freight, to millions of people who, perhaps, seldom stop to think what it means to mankind. We find people of portions of Europe are able to send us oranges, lemons, raisins, and other commodities first by steamship, thence by railways, and all these are given to us at such low prices, that we often wonder how it can be done, but it all comes largely from low freight rates. The people of Australia and New Zealand send to our shores mutton, butter and other commodities in large quantities, and compete with our growers here. From Spain we receive onions at such low prices that it really does not pay us to grow these large varieties here. I am told that these have been laid down in Toronto at $1.65 per case of about 130 pounds this year, even though we have a duty of 30 per cent. against them and transportation of a few thousand miles to pay for.

We find also on account of low freight rates that our country is fairly flooded with onions from the United States this season. We are also having potatoes delivered in the Province of Ontario from New Brunswick, and I understand the freight rate is 20c. per 100 lbs., and, as a matter which we think very unfair, we have to pay 32c. per 100 lbs. on onions to the same Province. Just why there should be such an unfair rate, we who are engaged in that business fail to see. There are no doubt many imperfections in rates which should be attended to by those concerned. In the western part of the Province we purpose trying to lay before the Railway Commission a series of what we consider unfair rates and endeavor to have them arranged more on an equable basis. We are largely shut out of the west beyond Winnipeg on this account, and we think that trade is ours by right. But to obtain it we shall have to put up a good fight.

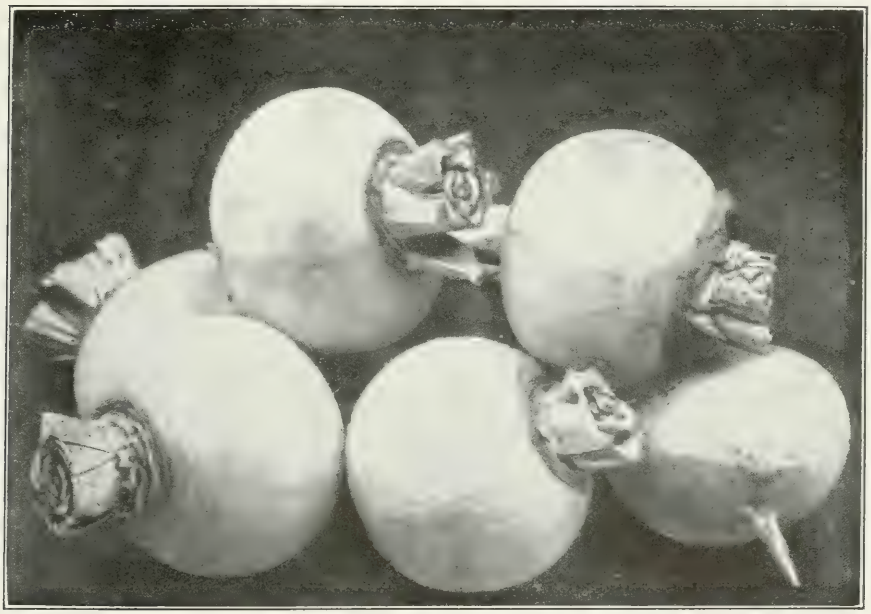
In a general way we have a great deal to be thankful for as things are. While freight trains do run very slow, still in time we get our goods through to destination. At times we find where we start out cars to the west, that even though we ship a car a day, very often they arrive 4, 5 or 6 at a time and this always causes a loss to the shipper when so much is thrown on the market at one time. The same thing happens here in Toronto, and somehow we are unable to get prompt delivery to the fruit market. The same applies to Montreal. We hope something can be done in the near future to put the transportation business on a better basis, not only in more prompt delivery at terminals but better car service and we then can feel more satisfied with our business, and our customers also will be able to move such larger quantities of our products. We in Leamington have to pay 32c. per 100 lbs. to bring onions here. It costs 11c. per bag from New Brunswick to Toronto, and from Leamington to Toronto 10½c. a sack.

J. Lockie Wilson: What is the price per 100 lbs. from New Liskeard to Toronto?

E. E. Adams: 40c. in broken lots and 22c. by car. I shipped tomatoes in carload lots to this city, leaving Leamington at 2 o'clock in the afternoon; they arrived at Walkerville Junction 4.15, and in West Toronto the following morning about 5 o'clock. It took three days to get them down to Toronto. We had made arrangements to have these goods taken out promptly on their arrival in West Toronto. They could not locate some of our cars for three days, the consequence being we lost half the value. I shipped goods to Montreal on a Thursday, they arrived there on Sunday and were delivered to consignee on Monday. We also sent a car to Montreal on Friday. If it had been in Montreal on Saturday it would have brought 60c. a basket, whereas on Monday it brought 32c. We got practically no redress—the railroads are hard to beat. We can get no better service from the C. P. R. than from the Michigan Central, because they have

not got sufficient cars. In regard to the question of rates I mentioned, five years ago the rate to Halifax and St. John was 26½c. per 100 lbs. on onions. The rate was later changed without any notice to 28c. and last February, the Railway Commission raised the rate to 32c., and they explained it by saying that they wished to equalize matters. How absurd it is. We had a rate of 32c. while that on apples near Brantford was quoted at 27c. Of course we lose business from this. It looks to me as though the Railway Commission would not be doing such an injustice to the onion growers or potato growers in that district or any other district if they asked the growers if they had any objection to these rates and why, but this was never done. These are some of the troubles we have. They could be enlarged up, I will not take up any more of your time.

THE PRESIDENT: With regard to the transportation problem, there is a feel-



Perfect Model, Early Turnips.

ing of dissatisfaction that the Executive of the Ontario Vegetable Growers' Association have not done as much as they could. Our position is that we could not do anything without sufficient information to work on. If any member of the Association or any vegetable grower in the Province would furnish us with the particulars of any definite case of injustice in rates we would take the matter up, but this has never happened, consequently nothing has been done. We had letters from two growers, and I replied to both, and asked them if they would furnish me in writing with any cases they knew of where unjust rates were being charged or where any injustice was being done, and I would have the matter thoroughly investigated. I received no reply. We must have definite information to work on. It appears to me that the growers at Leamington have a grievance. The matter should be taken up in your local branches and discussed; and if you come to the conclusion that you are unjustly discriminated against, write out a statement of it and send it in and your Executive will be very glad to co-operate with you, and place it before the Railway Commission.

J. Lockie Wilson: We owe Mr. Adams a debt of gratitude for his splendid presentation of this discrimination in rates. We should take action at once in the cases stated by Mr. Adams, and I am sure others will come up if matters were investigated. This Convention would do well to pass a resolution appointing a delegation to wait upon the Railway Commission with Mr. Adams, as chairman of that delegation, and I am sure with the presentation that could be made, prompt relief would be given to the men who are producing farm and vegetable products in this Province. The two things that are really of the utmost importance to this organization are transportation first and co-operation afterwards.

A Member: The Fruit Growers have taken this matter up and appointed a Committee, who waited on the Board without good results. They now think the best way is to appoint a permanent committee and have a strong outside man who knows all about this matter to look after things. Fruit and Vegetable Growers have not the time. They are too busy. They have a thousand things to do and are only able to do five hundred, consequently, the Fruit Growers have appointed a Special Committee to examine into the question, with a man outside with a strong interest in the affairs of the Association, whose business it is to do it all the time. This is the only way you will get results. The great thing is to gather evidence: to get the people to go after it at the time. A grievance in July at the end of the season will have evaporated to a great extent. Your Committee should co-operate with the Fruit Growers. Double strength will help both parties, and they may have some pointers that they can give you, and you, probably, will have some good ones for them. But you require strong, united action, and I would suggest that you appoint two separate Committees to act in conjunction.

W. J. Kerr: I believe in hitting the iron when it is hot. I would move that our President, Secretary, Mr. Reeves, and Mr. Adams, with others, be appointed as a Committee to interview the Railway Board when they meet in Toronto and press this matter and see if we cannot get something to remedy the trouble.

B. Davis: I second the motion.

A Member: The Committee just appointed should co-operate with the Committee of the Fruit Growers, and then we can either go in a body to discuss the matter, or any other way decided upon.

The President: It is understood that we will apply to the Fruit Growers for permission to co-operate with them.

The motion was unanimously carried.

CROP COMPETITIONS.

Prof. A. H. McLennan, O. A. C., Guelph.

During the past summer I visited most of the plots in the Crop Competitions of your Association throughout Ontario.

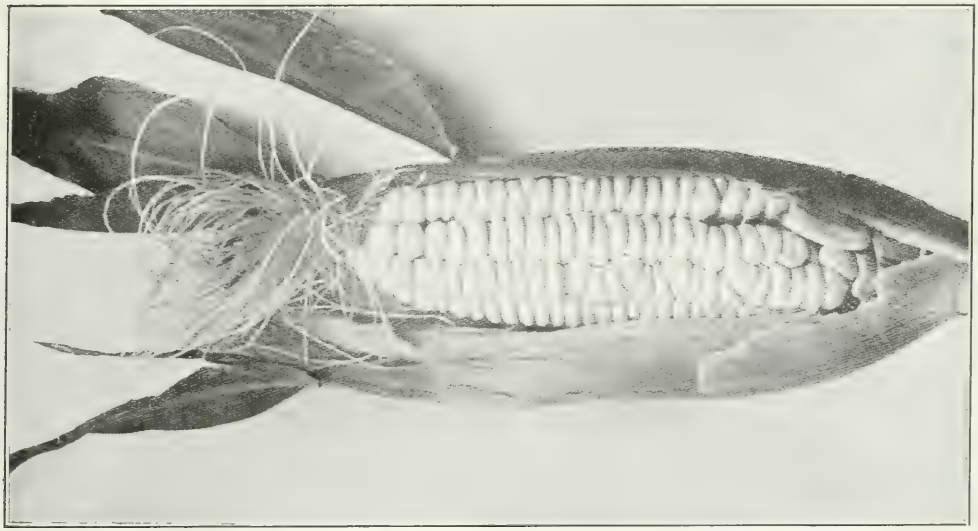
The enthusiasm shown by each member was commendable, and would point to the success of the competitions in the future. There are changes that need be made, but this is what would be expected where such competitions are in their infancy.

First, there was much uncertainty as to varieties, and whether the crops were the early or late ones. In onions, none knew whether they were from seed sown directly in the field or from transplanted ones, also there was a difference of ideas

regarding color. Around Ottawa, nearly all the onions are red; in Western Ontario yellow. This is a matter which your Executive can easily decide before the next competition.

There were also different ideas as to the rules governing the competition among prize winners at Toronto. More especially was this seen with regard to celery. Many did not send a sufficient quantity to fill the box specified. One very fine sample from London had been packed in a tight box, and when opened was heating. It should have been packed in an open crate. It would be better in a competition, where the article is perishable, if each contestant would send a larger quantity than required, and then it would be repacked on arrival in Toronto, as the celery was this year.

Another point should be looked into, and that is the arrangement of the various districts. While, under the circumstances, your executive did the best that they could, I would suggest that, if possible, each branch be made a separate dis-



Garden Corn.

trict, and the prize winners brought to Toronto as was done this year. This would seem to me to be fairer to all concerned.

During my trip much information (valuable especially to me) was gathered, and I ask your permission to dwell upon this, hoping that it may be of use to some of you. The gardens visited varied in size from five to thirty acres, the average being about ten acres. To me the use made of every inch of ground was very interesting, in some cases even line fences being done away with. The absence of any quantity of weeds and the healthy appearance of most crops showed the constant care. More striking is this, because most of these men apply fresh manure to the ground. Many use fresh manure, others compost it. Now which is right? It is a question which to me would seem to be worth working out on a dollar and cents basis.

Another point is the absence of seed selection in crops such as tomatoes, which growers could easily carry on and which but few do. This is so easily done, and the results are so striking that when once it is tried it is never left undone. Many

of you pay high prices for certain seed each year, whereas if you marked certain plants each year in your crop and took your seed from these, your returns would be larger.

Combination and inter-cropping are factors in truck gardening that I found being applied to a large extent, especially at Toronto and London. These, of course, are more applicable where the area is small and land prices high. Here are a few combinations which I think worthy of mention:

Radish, Spinach, and Celery.
Radish, Early Cabbage, and Celery.
Lettuce, Onions, and Cauliflower.
Lettuce and Parsnips.
Early Potatoes and Celery.

Youthful Vegetable Growers.

The large returns per acre from these combinations show their value. As one man said, everything is double cropped except seed onions.

I was agreeably surprised at the large amount of ground used for transplanted onions. Since taking charge at the College, I have been doing some work along this line with the Denia, Ailsa Craig, Sutton's A1 and White Leviathan. I have made arrangements with one or two men to co-operate with me in carrying the work still farther, and would be glad to have others join.

Irrigation of crops is a subject which is interesting many of our growers. The dry season last year and the year before has convinced many that we must have a constant water supply if we would have maximum crops in any season. I saw several very complete outfits, especially at Byron. This year we placed four and a half acres under the Skinner System at the College. We have had a small system for four years and have found it very satisfactory. There is still much work to be done to obtain a pump which will supply water as needed.

Mr. McInnes, of London, had a very interesting method of irrigation, or rather sub-irrigation. His soil is a black muck underlaid with tile drain about eight feet apart. There are numerous underground water courses, and he has his tile system so arranged that he can turn the water from these streams into his tile and so sub-irrigate. It reminded me of the section around Sandford, Florida, of which we hear so much.

I was interested in a method of celery culture which I saw on the farm of Mr. R. Topper, of Woodbridge. He sows the celery seed in the permanent rows. The thinnings are sold or transplanted. He claims it to be very satisfactory. He grows only winter celery and had a fine stand of plants.

At Cook Bros., Kingston, I saw the earliest muskmelons to be found in the Province. These gentlemen use the methods of the Montreal growers, and certainly had succeeded well.

The best types of greenhouses and crops to grow in them are questions which I am asked every day. The trade in indoor vegetables is increasing, more especially for high class articles. In many of the smaller towns there is a growing market which takes indoor vegetables that were not thought of a few years ago. The advantages of having plants more advanced for outside planting, as tomatoes, is coming more and more to be recognized. Hot beds are good in their place, but if one wishes to cater to the early market he will find many uses for a greenhouse. It also helps to solve the problem of hired help by providing work the year round.

The question of diseases and insect pests is one that must be carefully looked into. There is as yet no really sure remedy for the Onion Maggot. At Guelph we have been troubled but little with it. I sometimes think the amount of wood ashes we use is detrimental to it. One man in Ottawa has lost much of his indoor Tomato crop from blight. At London I found plants affected with a disease which outwardly looked like wilt. Upon examination it was found to hold traces of Sleeping Disease, one of the deadliest tomato diseases. In each case I suggested remedies, but I think much more could be done to aid growers.

Mr. Hull, of Ottawa, had a very interesting crop. He grows asters among his trees and sells the bloom in the city. He said it paid well. Many more of our gardeners would do well to raise a few flowers, if for nothing else than giving an attractive appearance to their premises.

CROP COMPETITIONS.

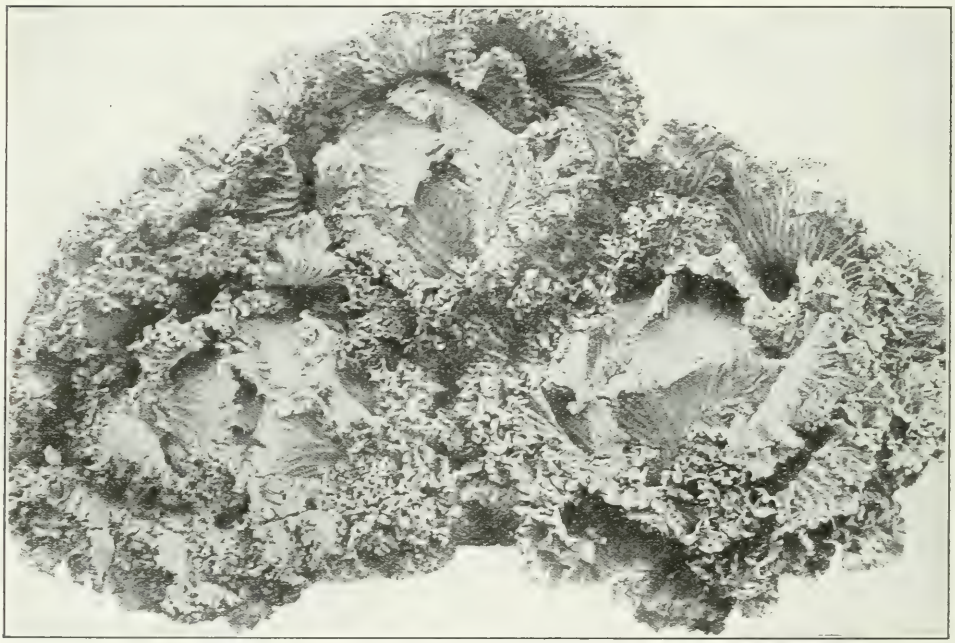
T. G. Raynor, Ottawa.

I have listened with great interest to the addresses delivered at the Convention of this progressive organization. I was delighted to learn that you had adopted the idea of competition in crops by encouraging it, in offering prizes to those who are the most successful in conducting certain lines of crops, who would enter the competitions, and now that you have made a beginning, there is no doubt that you will show great advancement from year to year. My work has been largely in connection with Field Crop Competitions, and these have proved very successful. I believe in these competitions, because they promote the right kind of rivalry. Where prizes are offered in any competition they will stimulate men to do their very best in the growing of any kind of crop they are interested in.

In order to succeed in this work I believe the first principle to follow is to have an ideal, if possible, and to work always with that ideal in view. We should read; study the conversation of men who had succeeded in doing the very best with these crops, and in so doing obtain the very best ideal possible. Then we should try in all our methods to build up that ideal, and if we do this we cannot help advancing along those lines.

Certain laws govern certain crops in nature, and in order to get to the bottom of this every man must have that ideal in his mind as nearly perfect as possible. Give me the man who understands principle well enough to select the plant that will meet his ideal in the growth or development of the crop he is after. He will be in the prize winning line when it comes to competition of any kind.

What will be the results of the working out of this ideal? It will bring about greater care in seed selection.



Drumhead Kale.

There is an opportunity for the vegetable growers in this country to more and more grow their own seed. It would be far better to save seed from plants and sow these rather than to go to seedsmen and try some fancy variety that is being put on the market at fancy prices. Another thing these Field Crop Competitions emphasize is greater care in the preparation of the soil. There are a few factors for the successful production of all crops. Seed alone will not bring about maximum results in growing crops of any kind. You must have proper preparation of the soil, soil not only finely divided, but deep enough in its bed. We have to depend on supplementing what comes from the clouds in getting that soil ready to hold enough moisture for the crops to draw on in the dry periods. We must also know what that soil holds in the shape of the necessary elements for successful plant growth.

It will aid us in the proper use of fertilizers, both stable manure and chemical fertilizer. The Vegetable Growers are very proficient in these ways. A great deal of waste occurs to-day in both the application of stable manure and chemical fertilizers. Soil does not need to be analyzed. Some of the vegetable growers throughout the Province put up unlimited quantities of stable manure, but if a man has an insufficient supply of this he can make it go farther and get good results by adding to that manure the right kind of chemical fertilizer, and experiments of this kind will lead men to discover the best use they can make of not only stable manure but also the chemical fertilizer to get the best results.

These competitions will aid us in raising the standard of quality among vegetable growers in all lines of vegetables. As a judge in the Field Crop Competitions, I believe the score card will be a great help to give these men good help. Some of the judges are afraid to give away too much information, but when I was in the work acting as judge, I always went after the grower, showed him the score card and told him how I had marked him for that point. If he fell below the maximum, I pointed out the facts; it was information to him, and next year, he could overcome that same fault by going over the score card.

These competitions help us in our knowledge of weeds and garden vegetables. It takes intelligence to fight weeds successfully, and their life history should be studied. There is scarcely a farm on which one or more nefarious weeds are found. Many of them can easily be smothered when small, but, if neglected, there is always a big fight for the farmer until he exterminates them entirely. We get a knowledge of these weeds and the best methods of how to deal with them.

These competitions also will enable us to discover the best system of storing our vegetables. All information we get about growing them to the best advantage will lead up to the further point of storing them in the proper way, and, of course, this will be a great advantage.

W. J. Kerr: In judging field crops for the Provincial Association this year, we were instructed positively that only seed onions were to be considered. I am not in a position to say whether it is fair or not, but I believe that in large sections of this Province onions are not planted at all, and, if this is so, we should have two classes, one for seed and the other for transplanted onions. We can hardly limit celery as to varieties, as in Ottawa we grow only the yellow, while in London they grow almost exclusively the white bloom. It would be difficult for us to limit to any one variety, because there are two varieties grown, one wholly in one district and the other in another; but in the score card we stipulated that 50 per cent. of the total number of marks should be given as the market value. That score card should be carefully drawn up so as to take into consideration local conditions. Where red onions are not profitable, yellow onions should have the preference, but in Ottawa, where there is no demand for yellow onions, red onions are preferred.

REPORT ON POTATOES.

T. G. Raynor, Ottawa.

I visited the potato fields of Messrs. Stephenson, Chester, Washington, and McFarlane during the second week in August, about ten days later than last year. I found that conditions in New Ontario had been like those in the older parts of the Province. The season had been peculiar. Although they had had an early seed-

ing time, which had been better than ours, they had had heavy rains, then a dry time and the heavy rains again. In June and July the frost did some damage to Mr. Chester's crop, it being frozen back twice. Notwithstanding all the disadvantages, the crop was a promising one, and a good yield of potatoes will result unless they are affected by the late rot. The stem rot was pronounced in all the pieces; perhaps more in Mr. Stephenson's than the rest. There was no sign of late blight. Blossoming was very profuse. Mr. Washington said that the potato beetle had been troublesome for the first time on new ground. They all had the beetle to reckon with, but had kept it pretty well in check.

Mr. Stephenson's Plot.

Mr. Stephenson, New Liskeard, had planted about two and two-thirds acres with Early Ohios. Some of the land was in a basin, and, consequently, retained the excessive moisture, which not only affected the stand but had developed a good deal of stem blight. The bulk of the crop was doing well, however, and the good hills should average six to eight marketable tubers at least. One of the best hills showed over 30 tubers, 20 of which would be marketable. The wet weather had interfered with cultivation to some extent and the weeds had not all been checked.

Mr. Chester's Plot.

Mr. R. D. Chester, New Liskeard, had planted part of his seed on the same piece of ground as last year. On the one plot, which was quite level, the higher portions showed the best stand. Although they had been frozen back twice, the tops showed a strong growth. The tubers were smaller than Mr. Stephenson's and would average less to the hill. They were clean and well moulded up.

Mr. Washington's Plot.

Mr. George Washington, Thornloe, had a little over two acres of entirely new ground, which he had cultivated well, and the crop was quite clean. The stand was weak in some places and the stem blight was taking some toll. The potatoes were not so well advanced as Mr. Stephenson's, but were more mature than Mr. Chester's. The good hills promised well and some fine seed should be obtained. The tubers were sound, clean, comparatively smooth, and all three plots should make good seed, barring an attack of late rot, of which there were no symptoms.

Mr. McFarlane's Plot.

At the request of Mr. John McFarlane, New Liskeard, I visited his crop of Green Mountains. He had planted about two acres, comparatively high but quite level, and conditions were about the same as for the other crops. His seed was not accepted last year on account of the scab. This year he planted those potatoes and I found no scabby ones at all. Others had tried the seed and they reported no scab. The potatoes were late but promising, and a good yield should be obtained. If they turn out all right, Mr. McFarlane would like the Association to buy them. The scores ran from about 73 to 80. The yield should be something over half a good crop and the potatoes all seemed true to variety.

Had the ground been well drained there would have been a bumper crop of potatoes this year. A few vines which grew beside an underground drain on Mr. Stephenson's farm showed this. They all stood up well and were healthy and vigorous.

GREENHOUSE WORK.

J. J. Davis, Byron.

When a man builds a greenhouse with the intention of growing crops in it, he lays himself out to grow these crops by artificial means. In the first place, he has to make his own weather and provision of soil. As to making climatic conditions, of course, we put in a plant to supply heat to take the place of the sun, and then we have to make inside conditions as near as possible what outside ones would be.

There are only about three crops that can be grown in greenhouses in this country—lettuce, tomatoes, and cucumbers. Others have been tried and, possibly, grown on a small scale.

We buy our greenhouse experience pretty dearly. It was my fortune to live beside a practical man when starting in the greenhouse business, and he was a thoroughly good fellow. I believed I was a pretty good lettuce grower, and it was through discussing the matter with him that I learned how to do so. To grow lettuce you must have in mind what kind of crop you want. In our London market the demand is for a large head of lettuce; a single head that will retail for 5c.

A Member: What will that weigh?

J. J. Davis: We get them sometimes to weigh 1 lb. In order to grow a good head of lettuce we have to plant them about five inches apart each way. In growing a crop under these conditions, we have to take into consideration the cost of fuel. It is high; the cost of the plant is very large, and we have to concentrate our energies in getting as much as possible off a square foot of ground, and in order to do that we have to get the soil rich. Some of you, who have had no experience, would not credit the amount of fertilizer and manure we put into our greenhouse. The quantity is simply enormous. It has to be; we could not make it pay under any other conditions. When you take into consideration that we want to grow three or four crops of lettuce, and follow them with tomatoes and cucumbers, you begin to get an idea of the enormous quantity of crops we take off a small piece of ground.

We have to keep conditions as healthy as possible, and carefully watch ventilation. You know that in growing crops outside you sometimes have a hot, close and sticky atmosphere. That is the time that light rain will start. We have to guard against this condition, not to have an excess of moisture inside, and to overcome that we have to be very careful in the matter of ventilation to keep the air fresh.

It is a question of losing a little heat or running the risk of doing the crop injury. Under that condition, a man should always burn a little more coal rather than run the risk of endangering his crops. In the winter, sometimes, weather conditions outside are very cold, and it takes quite a lot of coal to keep the inside up to normal, and a man thinks if he opens up the ventilator that he is wasting coal. This is a big mistake. It is better for him to open his ventilator a little, even if he has to burn a little more coal. The prime idea is to keep the inside healthy, and to do that you must have fresh air. Air can be a long way from being fresh, even if cold. You feel it quicker if it is warm and impure, but there is more danger if it is cold and not fresh.

We are not independent of weather conditions. In wet weather we cannot avoid the house getting damp inside, and the only way to remedy this is to build a little fire and dry the atmosphere inside. It prevents mildew, etc.

A MEMBER: In regard to lettuce, is it a fact that in some cities, particularly in Hamilton, they cannot get head lettuce? If so, it is a great slur on the Vegetable Growers that they do not grow their head lettuce in larger quantities. On the other side, in California and Boston, you can get any quantity. I understand there is some difficulty in growing it in Canada.

J. J. DAVIS: We do not grow any head lettuce around London because the people do not want it. We concentrate our energies on growing what the people want, as we have some difficulty in finding a market for head lettuce. I have been told that this Boston head lettuce can only be grown with good success in Boston; that there is something in the air or soil near that city which assists in it growing to perfection. This may be so, because there are lots of vegetables that can be grown with greater success in one locality than in another; but if there was a good market for head lettuce in London it would not be long before some of us could supply the demand. We would grow it if the people wanted it, but they don't. Some people pestered me to grow some red celery. I grew some this fall for exhibition purposes, and a little more than I needed, about a dozen heads in all. It took me longer to sell those dozen heads than 80 or 90 of the other kind.

THE PRESIDENT: In the Eastern States Boston head lettuce is used exclusively. In the Middle States they grow the same as we use here. In Grand Rapids the same. The Eastern markets apparently call for this Boston head lettuce, and some growers in the neighborhood have been very successful in growing it. We can grow it all right, but the market is so limited that it does not pay us to go into it, and it takes different conditions than it does in Grand Rapids, and it would not pay us to install the same apparatus in our greenhouses.

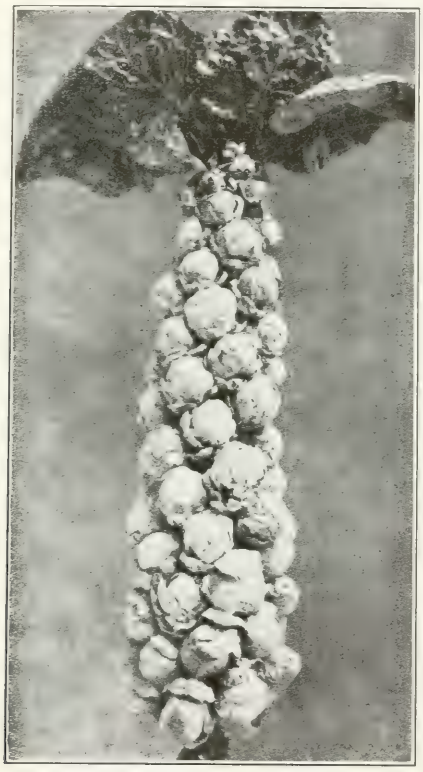
A. H. MCLENNAN: We have grown head lettuce three years at the College, and unless you go to an elaborate system of irrigation, you will not get a profit. There is no market for it. This year I am growing a certain quantity of it, but I have always found that if you use the least bit of over-heated water it injures all the others. Their method in Boston is to water it so that it will carry through a crop and a half before any of the ground is planted. Their soil is straight sand that has been enriched with manure. It is a black soil at the present time. They dig it to a depth of 18 inches, and water and water it until they fairly fill the soil with water, so that you see their methods are such that it would be costly, and there is not sufficient market for it here.

THE PRESIDENT: A pioneer grower of Boston explained his system to me. He put on eight or nine inches of manure every year and filled the soil with water and manure. The object is to hold the moisture to carry the crop through, which takes a period of eight or nine weeks at a time. Any overheated water will spoil the whole thing.

J. J. DAVIS: In Boston lettuce is selling at 40c. a dozen; here you get $1 and $1.50 a dozen. You can easily see they go to considerably more expense. In some places they install a system of irrigation, and by that method they are able to keep the top soil dry while the underneath is moist. Sometimes we have a bit of large lettuce that is fit to sell, and, perhaps, the market is not ready and you have to hold it, and, of course, we can hold it a great deal better dry than wet, but there is a limit to the time you can hold it, and I have been obliged sometimes to water it to keep it fresh. Unless a person is very careful it will rot. One has to use very good judgment in the use of water. We use the Skinner system of watering in London.

J. Ellis: In regard to cucumbers, we grow principally the White Spine and a very few of the English varieties. We plant them about the 1st of March, two inches apart. About four weeks from the time of planting the seed we transfer to permanent beds, and we set them about 24 to 26 inches apart. We keep White Spine in the house, but not the English varieties.

Regarding watering cucumbers, we use the Skinner system. We like this very much. It makes conditions ideal. Sterilization depends on the different kinds of soil. The first year I had an excellent crop. Next year I did not sterilize, and they were not so good; the year after I sterilized and they were as good as the first year. In regard to lettuce, last year I sterilized about a quarter, and they were ready in a short time. They are sterilized with steam. We put in tile about two feet deep; that is all that is necessary.



Brussels Sprouts.

A Member: Around Rochester they use 30 foot pipe and steam through that.

J. J. Davis: Since sterilization is mentioned, we got pans made the full length of the ordinary galvanized iron. They are about 3 and 4 feet wide and about 7 or 8 feet long. They are two widths wide and one length of galvanized iron; turned down about 8 inches; it is really an inverted van with a nipple in the centre. We turn the steam in there and let it set for 30 minutes. We fill a couple of gasoline cans and water one on each corner at first.

J. Ellis: The system I use is that used at Grand Rapids. It is working out much more satisfactorily than that of the pan. There should be a permanent heater along the end of the tile.

W. R. Vroman: Would sulphur be of any use to keep mildew down?

The President: I do not think so.

J. J. Davis: I use a little sulphur in the winter time. I walk around the house with a good handful of it and keep dropping it along; it burns and will not mildew or hurt anything by doing it. I do this frequently, and I have never done any harm. I evaporate it.

W. R. Vroman: When we put sulphur in the house early in the season, and keep it there, we have never been troubled with mildew. Will dull, cloudy weather affect the set?

J. J. Davis: It has a tendency to have an effect on the bees in the blossoms, but if the bees will work on a dull day, you will have just as good results. If you keep the bees outside the house on dull days, they won't work, but if you get them in the house they will work. Cucumber you will find will grow no matter what conditions are.

E. E. Adams: For the information of those who do not know, it costs $7.50 to manure a greenhouse, or fifteen carloads, as we get it from the Chicago stockyards at $50 a car.

VEGETABLE CULTURE IN GREENHOUSES.

C. W. Waid, Columbus, Ohio.

The management of a greenhouse is very different from the management of a market garden. The person who has had experience with outdoor gardening should, because of that fact, be better able to conduct the operations under glass; but he must not forget that conditions are very different in the two environments. If I were asked to name the most essential quality which will enable a person to succeed in the vegetable forcing business it would be, "the ability to give careful and constant attention to details." This, of course, should be coupled with a knowledge of the requirements of the crops grown.

Soils for Forcing.

Composition and preparation.—Most of the development of commercial vegetable forcing has occurred in localities where the soil was sandy or a sandy loam. It does not follow from this, however, that a sandy soil is necessary for a greenhouse soil. It is undoubtedly true that it is easier to get started when the soil does not need much except the addition of manure (as is the case with a good sandy loam) to prepare it for greenhouse crops, but by making a compost of sods, manure, and, if need be, muck, a clay soil, if not too stiff, can be made very satisfactory for vegetable forcing crops.

A soil which has a very large per cent. of sand in it is not as satisfactory for the greenhouse as a soil which contains a moderate amount of sand. This is especially true when the subsoil is made up of sand or gravel. Such a soil must contain a very large amount of humus to make it at all satisfactory. Muck is very much to be preferred to sand for mixing with a clay soil to make it more easily worked and more congenial to the forcing crops. If the muck used is acid, lime should be added to correct the acidity.

It is seldom that a grower has even a partial failure in the greenhouse the first season. Troubles usually begin after the soil has been in use two or more years.

Vegetable forcers do not make it a practice to change the soil in the beds or benches each season, as is the custom with the florists. One of the best crops of lettuce I ever saw was grown in a greenhouse in which the soil had not been changed in 30 years. The soils in many of the large vegetable forcing houses in this State have been in use for 10 or more years and will be in use, no doubt, for at least as many more. Some of the soils long in use are sterilized with steam each year, or at least frequently, while others are never sterilized.

The Summer Mulch.—One of the practices which some of the growers are following and which we have found very satisfactory is what we call "applying the summer mulch." As soon as the tomatoes and cucumbers are removed from the houses an application of fresh strong manure is made to the beds or benches to the depth of about six inches. As soon as the manure is in place, water is applied to the surface of the manure in the form of a spray, either from the Skinner system or through the hose. The manure is watered frequently, the object being to leach much of the fertility from the manure into the soil and at the same time to keep the soil supplied with a normal amount of moisture. Dr. Stone, of Massachusetts, found in his investigations that diseases are less likely to be troublesome when the soil is kept moist during the time no crops are growing than when it is allowed to bake and dry out in the hot sun. This is somewhat contrary to the belief of many greenhouse men, but investigations of Dr. Stone are much more authentic than mere opinion. The results which those who have used the summer mulch, as I have indicated, have secured are a further proof that Dr. Stone's deductions are correct. I do not know a grower who has followed this plan and has been careful in his work who has been seriously troubled with disease in the greenhouse.

Soil in the Seed Bed.—I wish to lay special stress upon the importance of keeping the soil in the seed bed free from disease germs. Much of the trouble which greenhouse men have had in the past with disease affecting the crops has been directly traceable to the seed bed. Healthy roots on seeding plants are very important. Some of the largest growers sterilize all the soil used in the seed bed. This operation kills two birds with one stone, as it destroys the vitality of all weed seeds and most of the disease germs are killed. Pure muck is an excellent medium in which to start the young plants. Plants grown in sterilized muck nearly always form a wonderful root system. If the soil is not sterilized it should be used but once and care should be exercised that serious diseases are not introduced through the manure which is used in making the compost heap.

Lettuce.

Undoubtedly lettuce occupies the beds or benches more of the time in most greenhouses than any other crop. Where lettuce is sold by the pound the amount grown per square foot during the season should be as great as possible, as long as the quality is not sacrificed for quantity. By planting the first lettuce September 1st and following one crop immediately with another, 3 crops should be grown each season in addition to a crop of tomatoes and cucumbers. It has been my experience that the markets do not like large coarse stalks of lettuce. Plants which run three or four to the pound on an average are satisfactory to the trade and will give a good yield per square foot. After careful tests extending over many years we have decided that 7 or 7½ inches each way give the best results.

There is quite a variation in the way different growers handle plants when setting them. Some growers pay little or no attention to the matter of keeping the dirt on the roots, while others are very careful about this. Pot grown or flat

grown plants can be set much more easily with dirt on the roots than bench grown plants. Personally I very much prefer the pot grown or flat grown plants. I do not like a spindling overgrown plant, as it is much more likely to become diseased than a stocky medium size plant. The reason for this is that the leaves on the large plants will often fail to revive after setting and remain prone on the soil and finally decay, thus furnishing an excellent medium through which disease germs may gain access to the healthy tissues of the plant.

Potting lettuce plants requires a great deal of time and some growers no doubt believe it not practicable. There are many who do, however, as thousands of lettuce plants are grown in pots in Ohio every year. We have used pots and find that they are profitable. As our plan of using them differs from any other I have ever seen, I will describe it in detail. The first crop is grown in flats. The seed for the second crop is sown early enough to insure a sufficient amount of time for the full development of the plants. They are pricked out into flats first, then before they begin to crowd they are put into two inch pots. These pots are plunged in benches or beds between the permanent lettuce plants. The potted plants are spaced one way the same as the permanent plants but as close again the other way. The pots are plunged sufficiently deep in the soil to insure capillary action from the outside soil through the bottom of the pot into the soil in the pot. The watering which the permanent plants get takes care of the potted plants. After the plants are potted they demand little or no attention until they are ready to set in the permanent beds. By handling plants in this way they may be grown much larger without injury than when they have less room. When transplanting pot grown plants there is practically no check and they start to grow at once. By following this plan for all except the first crop, at least two weeks' time is gained per crop. It will be noted that there is no loss of permanent bench space when the pots are plunged between the permanent plants: thus, the only expense added by following this method is the cost of the pots and the labor cost of potting the plants. This is in part off set by the ease with which they are handled after they are plunged in the beds.

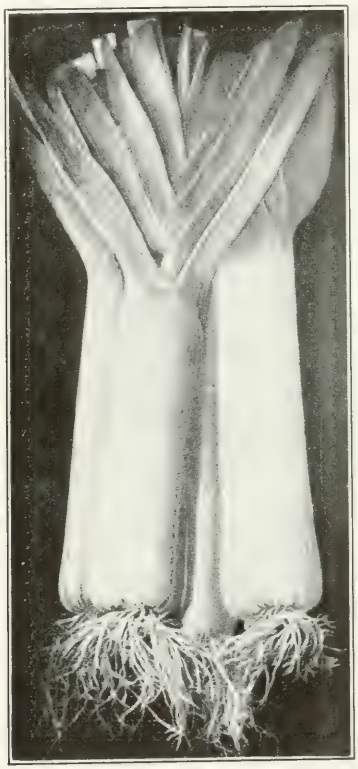
The reduction in the time the plants occupy the beds after they are set is almost clear again, and time is money in the forcing business. This plan is highly desirable for a person with a small greenhouse who wishes to get the greatest possible cash return from the crops grown.

Watering.—One of the things which is often overlooked is the importance of thorough watering immediately after the plants are set. The roots of the newly set plants occupy a very small amount of space and it is necessary for the best growth of the plants that a sufficient amount of water be within reach of these roots to supply the needs of the plants at this time. It is difficult to get the soil too wet at this time, but easy to keep it too dry.

After the plants have established themselves less water is needed, but even then I have frequently seen crops suffering from lack of water. One of the difficult things is to supply sufficient water at all times without keeping the surface of the soil too wet. Here is where sub-irrigation comes in for its share of praise. I have had a chance to compare sub-irrigation with surface watering as the two methods have been in use under my daily observation for over ten years. I have no hesitancy in saying that, so far as results are concerned, sub-irrigation is far superior to surface watering for lettuce and tomatoes. For cucumbers and radishes there is less difference between the overhead or Skinner system of watering and sub-irrigation, the overhead being preferable at least for cucumbers. The

most serious drawback to sub-irrigation is the first cost. Watertight benches or beds must be provided for this system of watering and these are expensive. There have been several inquiries recently in reference to this subject and I am sure that sub-irrigation is going to be used more in the future than it has in the past.

Beds vs. Benches.—As I have touched upon the subject, I might say a little more about raised benches. There is no question but that raised benches with heating pipes underneath are much to be preferred as compared with ground beds for growing of tomatoes during cold weather. One example to prove this assertion. A ground bed and a bench, each 100 feet long and 6 feet wide, were set to the same variety of tomatoes on the same day. The plants were the same age and as nearly



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alike as we could select them. Every condition was very much the same except that one bed was on the ground and the other raised. The raised bench produced 500 pounds of fruit before the ground bed had produced a pound. The total yield from the two beds was not greatly different, but in the greenhouse, as outside, the early tomatoes bring much better prices. I attributed the difference to the fact that the soil was warmer and the roots more confined in the bench than on the ground bed. Raised benches are superior to ground beds for lettuce also, as the sub-irrigation enables the grower to keep the surface of the soil dry as well as the lettuce leaves and in this way danger from diseases is less on sub-irrigated benches than surface watered soils.

This may give the impression that I am urging growers to use benches and sub-irrigation. As I have said before, benches are expensive and many growers

cannot afford to put them in. A person who can afford the expense of erecting raised benches, at least in a part of the houses, will find it a profitable investment, especially if he wishes to grow tomatoes. Reinforced concrete benches supported on gas-pipes are probably the most satisfactory form of bench to use where it is desired to provide for sub-irrigation.

Temperature and Ventilation.—Temperature and ventilation go hand in hand. A high temperature without ventilation invites disease, while a high temperature with an abundance of ventilation is not so dangerous. It has been my experience that Grand Rapid lettuce should be given a higher temperature than many persons recommend. Where the houses are separated so that different temperatures can be maintained at the same time, a night temperature as close to 48 as can be secured for the early growth of crop, with a drop to 45 or a little lower as it approaches maturity is what I would prefer. Where one temperature must be maintained for the entire greenhouse a night temperature of 45 to 48 is quite satisfactory. A drop to 40 degrees with closed vents does no harm except to retard growth. A temperature of 50 at night is sure to bring on some form of disease, if long continued.

Day temperatures vary according to the amount of sunshine. The heating pipes should be shut off when the temperatures give promise of rising too high. Too much stress cannot be put on the importance of keeping the ventilators open whenever possible. More growers are at fault in this particular than with any other operation connected with the forcing of the crop. Time and again I have gone through greenhouses when every ventilator was down, even in the middle of a cloudy day and the temperature comparatively high. The disease known as lettuce drop and all forms of rot will seldom occur in a well-ventilated house. It is false economy to try to save fuel by keeping the vents closed nearly all the time. Better growth, less liability to disease, and more agreeable air to work in will result from the proper ventilation.

Preparing Crop for Market.—The experienced grower will learn to tell when lettuce should be cut to give the largest yield per square foot and the most satisfaction to the consumer. Mature lettuce has a firm feeling when the hand is pressed gently on top of the plants. If it has been left until brown spots have begun to appear on the edges of the leaves it should be cut at once. To cut lettuce before it will give a yield of at least three-fourths of a pound per square foot is selling it at a sacrifice.

Too many growers are afraid they will loose too much weight by pulling off yellow and partly dead leaves. This is a serious mistake, as the leaves get more unsightly as they are kept from day to day. The dealer and the consumer will handle much more nice, clean, crisp lettuce, even at higher prices, than they will unsightly stuff at any price.

Tomatoes.

Two crops of tomatoes can be grown profitably in greenhouses, the fall and early winter crop and the spring and early summer crop. The fall crop is much the harder to grow, but aside from time of planting the methods which will give the best results in either case are very similar. To succeed with the fall crop it is very important to get the plants started early enough, so that the fruit will all be set and much of it fully grown before cold weather comes.

We have made a practice to get the spring crop in the benches as near the first week in March as possible. The time the plants are set in the permanent beds governs the time of ripening to a far greater degree than the time the seeds are

sown. Some sow the seeds the first of December for this crop and others early in January. If a temperature of 60 or above can be maintained for the plants, the first of January is as good a time to sow them as before. If such a temperature cannot be maintained, the seeds should be sown earlier.

The plants should be kept growing from the time they are up until they are ready for the beds. Frequent transplantings will make them stocky. They should be 6 to 8 inches tall when planted. We have found 2 by 2 feet or 2 by 2½ feet good distances to set the plants. If set the closer distance there should be but one plant in a place, and it should be trained to one stem. When set 2 by 2 feet or 2 by 3 feet some growers train the plants to two stems, using the first lateral above the first flower cluster as the second stem, owing to the fact that it is usually the strongest lateral. A few growers set two plants in a place and train them the same as they would two stalks from one plant. The advantage claimed for this plan is that the extra plant will produce one cluster of fruit below the point where the secondary branch of a two stemmed plant sets fruit. As this cluster will be an early one the amount of early fruit will be considerably increased. While I have not tested this plan sufficiently to be positive as to its merits or demerits, the added expense of growing so many more plants is not justified by the added returns. I prefer the single stem, close planting plan.

Training and Trimming.—We have found twine attached to wires strung above the rows and fastened to a home-made screw-wire, which is screwed into the soil near the plant at the time of setting, a very satisfactory method to use for supporting the vines. With the strings fastened at both ends the plants are simply twisted around the strings and tied two or three times with raffia. If the raffia is not used the weight of the fruit may eventually cause the plants to slide down the strings.

Wooden strips are used to support both cucumbers and tomatoes. They are 1½ by ½ inch in size and 6 to 8 feet long. A short strip is nailed across the bottom to keep it from sinking into the soil. Small nails are driven through the wood at intervals of 8 to 10 inches, one nail opposite the other. After the nails are driven through, one nail is bent at right angles so that when turned it will drop on to the other nail. These sticks are fastened to wires at the top and the bottom placed near the plants. As the plants grow, the vines are placed against the stick between the nails and the bent nail dropped in to the other nail, and the vine is fastened. It is a neat, quick method of training vines, the cost of the sticks and the work of nailing them being the chief objection to their use. They would more than pay for themselves, however, in the course of a few years.

The pruning of Tomato vines is comparatively simple, although it requires prompt work and a good deal of it. When the plants are to be trained to one stem all laterals should be removed when small enough to pinch off. If they get too large for this, a knife may be used, but care must be taken not to cut off the terminal or main branch. When two branches are to be left, the other laterals should be removed the same as in the previous case. After the plant has reached the desired height, which will depend upon the variety, height of house, length of time the plants are to be allowed to produce, etc., the terminal bud should be cut off to stop growth of vine and send all energy into the development of the fruit.

Care should be taken when pruning not to use the fingers or knife to break off healthy laterals after diseased ones have been removed, until after the knife or fingers have been sterilized.

Pollination.—The pollination of Tomatoes is a somewhat unsettled problem. One thing is certain that honey bees do not work on Tomato blossoms. Generally speaking, a certain amount of artificial pollinating is necessary to produce a sufficient number of well developed fruits. I have known cases where good, smooth crops have been produced without artificial pollination having been resorted to. Such cases are exceptions rather than the rule. I have also seen a good deal of irregular ill-shapen fruits as a result of lack of artificial pollination. Some varieties need more attention than others in this respect and the weather at the time the flowers are opening governs this matter somewhat. If it is such that the vents can be thrown wide open the currents of air thus started seem to help to carry the pollen from one flower to another.

The methods employed for the purpose of pollinating the tomato flowers vary somewhat. Some growers do nothing but jar the plants occasionally. This is certainly better than nothing, and under favorable conditions produces good results. Other growers use a camel's hair brush and claim it is satisfactory. Others, including myself, have used a wooden spoon and ladle with handles about 18 inches in length. This method requires much time, but we have never had a failure in our crops and, until I am sure that something else is better, will continue to use and recommend this method. The blossoms should be gone over at least three times a week. Only those which are wide open need be treated.

Picking and Packing.—The superiority of the greenhouse grown Tomato over the southern grown fruit is due, in a large measure, to the fact that southern grown tomatoes must be picked green. We have endeavored to keep this in mind when picking the greenhouse grown tomatoes, and for that reason have picked only those which are fairly well colored. The vines are all gone over three times each week. We have usually packed our tomatoes in four-basket carriers, about the same size as those used by the southern grower. Because of the fact that there is too much danger of the purchaser thinking the fruit so packed is southern grown, I believe a small basket holding not over 20 pounds with solid cover and straight sides would be preferable to the small basket carrier.

We have never wrapped our fruit, as it has usually been sold nearby. We have been, however, very particular as to the quality and condition of the fruit which goes into the baskets. It is much better not to offer for sale at all any inferior, irregular-shaped or, in any way, undesirable fruits than to try to work them off on the customer. Second grade fruits, if there are any number of them, will usually find a ready market at half price, but be sure that no second grade fruits get stamped first grade.

Diseases.

When crops grown in the greenhouse are given the best conditions possible for their growth, loss from diseases will be reduced to a minimum. In other words, preventive measures are much to be preferred to a cure. In all my greenhouse experience I have never been obliged to sterilize the soil, and we have never suffered serious loss on account of disease attack. This is not saying that we have never been troubled with diseases, but rather that they have never been serious enough to do a great deal of harm.

A very large per cent. of the trouble which greenhouse men have had with diseases was due to some neglect or to a lack of knowledge on the part of the grower of the requirements of the crop which had become diseased. I also admit that, when

certain diseases gain a strong foothold, drastic measures are often required to stamp them out.

One of the mistakes which many growers make is to "baby the crops too much." By this I mean that they are handled in much the same way so far as admitting fresh air is concerned as a nurse handles a new-born babe. It is my belief, based on many years' experience and wide observation, that we should endeavor to grow the plants in the greenhouse so that they will be hardy and able to resist disease attack. This can be done by providing abundance of ventilation and making good use of it. If plants are kept in a hot, humid atmosphere all of the time, they become tender and easily injured by exposure to cool and sometimes even fresh air for only a short time. If these same plants are given fresh air every day, and in warm weather at night as well, they will become much more hardy and, therefore, much less liable to disease attack.

While prevention of disease is the keynote to success there are many cases where specific treatment is necessary.

Lettuce Wilt and Rot.—Lettuce drop or rot is to a very large extent kept under control by giving plenty of ventilation. As soon as a plant shows signs of any form of this disease it should be removed and destroyed. Rotten plants or even leaves or roots should never be worked into the soil. I saw one instance of this kind where everything in the nature of waste was spaded into the soil. The result was that the rot became so bad that patches of lettuce several feet in diameter would rot down with every crop grown, and the trouble finally became so serious that steam sterilization was resorted to.

Steam Sterilization.—When serious losses occur from drop or rot and the trouble cannot be corrected in any other way the soil should be sterilized with steam. There are no fixed rules to go by in performing this operation. The purpose is literally to cook the soil with live steam and thereby kill all of the diseased germs. There are two general plans for sterilizing. Sections of the perforated pipes are buried in the soil and steam forced into them at high pressure for from one to two hours, after which they are moved to another place and the operation repeated. The other plan is to use what is known as the steaming or sterilizing pan, which is made for the purpose. Numerous perforated pipes extend below to a depth of about a foot. The steam is forced into the soil through the pan and pipes. The claim made for the pan is that it is more convenient, as no dirt needs to be handled. Some who have tried the pan and pipes in comparison prefer the pipes, as they claim the work is more effective.

I have never heard anyone claim that steam sterilizing injured the soil where it was sandy, but I have heard growers say that their soil was injured when it was somewhat heavy and contained considerable clay. The claim was made that it "killed" the soil or, in other words, made it less active. This seems reasonable as no doubt many of the beneficial soil bacteria would be killed. Steam sterilization is an expensive and unpleasant operation at best, and every effort should be made to avoid the necessity of its use.

The use of steam to sterilize the soil in which the seed is sown and the young plants grown is less objectionable as the work can be done in a box through which perforated steam pipes are run and the amount of soil needed for that purpose is comparatively small.

Lettuce Rosette.—When lettuce rosette gets started, sterilizing with formaldehyde can be made quite effective and can be done at less expense than sterilization with steam. Two or three pints of formaldehyde to fifty gallons of water is

the amount generally recommended. Drench the soil with one gallon of the solution to each square foot of surface. Two weeks should elapse between the treatment and the setting of the plants.

Nematodes of Tomatoes or Cucumbers.—When the roots of tomatoes or cucumbers become affected with nematodes the soil should be sterilized with steam.

Point or Dry Rot of Tomatoes.—The point or dry rot of tomatoes is due largely, if not entirely, to a lack of sufficient water in the soil. If the supply of water is always sufficient for the needs of the plants no point rot will occur. If it gets started the addition of water to the soil will stop it. The use of mulch on surface-watered tomatoes helps to keep the supply of water in the soil constant, and thus reduces the liability of danger from the disease known as dry rot.

Tomato Leaf Blight.—The tomato leaf blight, which can be detected by the velvety coating and light-colored spots which show on the under sides of the leaves, is nearly always present on forcing house tomatoes. Whether it does damage or not depends largely upon the time of its attack and the rapidity of its development. If the plants are approaching maturity before this disease gets a start no harm will result. In fact, I am not sure but that it is a slight benefit under these conditions, as it causes the fruit to mature somewhat earlier than it otherwise would. If, on the other hand, this disease should start to develop when the plants are small, serious harm would result. It is wise, therefore, to be on the lookout for it, and, if it does appear early, apply Bordeaux at once, directing the spray to the lower sides of the leaves.

Leaf Diseases of Cucumbers.—Leaf diseases of cucumbers sometimes do considerable damage. Downy mildew is probably the most serious of these diseases. Bordeaux is the best remedy and should be used before the disease starts if you can foresee this. At any rate it should be used as soon as the disease makes its appearance.

Insect Enemies.

There are two bugs which are frequently very serious on cucumbers, as they not only feed upon the plants, but are also the means of distributing diseases. I refer to the "stink bug" and the striped cucumber beetle. These are serious pests when they once get started in a greenhouse. Their entrance should be avoided if possible. I think that it will be necessary in time for growers to screen the vents against those insects. They can be killed by fumigating with hydrocyanic acid gas, but this is an expensive and dangerous material to use and should be resorted to only when all other means have failed. No crops which will harbor these pests should be grown in close proximity to the greenhouse. A grower should be on a constant lookout for these insects in the greenhouse, and he should kill every one he can possibly catch. The eggs of the stink bug are not hard to find and should be watched for while at work in the houses. They are laid in clusters on the underside of the leaves, and are orange or red in color. The wilt of the cucumber is frequently directly traceable to the work of these insects.

TRANSPLANTING MACHINES.

Where cabbage, tomatoes and other crops which require transplanting are grown in large quantities, the work of setting the plants in the fields is greatly facilitated by the use of the transplanting machines which are drawn by a team.

The essential features of these machines are a device to open a small furrow, a tank for the supply of water, and disks or blades for closing the soil about the

plants. With a transplanting machine it is not necessary to wait for a "season," as the machine automatically throws a small quantity of water around the roots of each plant as it is being set. In operating these machines it is necessary to have a steady team and two active boys who are trained to drop the plants at proper intervals, as indicated by a spacer on the machine. Under reasonably favorable conditions, a machine will plant from three to four acres a day. In addition to being labor savers, these machines do the work better and more uniformly than is ordinarily done by hand.

The plants can be set without the use of water, but the results are more satisfactory where it is used. A number of successful growers use water when setting after a rain, claiming that it has the effect of setting the soil firmly about the roots of the plants and that they start into growth much more quickly. Where the full amount of water is used it will be necessary to provide a man and team to haul it to the machine, but by this method plants may be set during dry weather without the loss of more than one plant out of every hundred.

The majority of the transplanting machines are designed for planting either on the tops of ridges or on the level. The cost of setting an acre with one of these machines, using water, should be figured on the basis of two teams with drivers and two boys for a period of three or three and one-half hours. If water is not used there will be a saving of at least one team and driver and the time required for filling the tank on the machine. Potato planting attachments and fertilizer attachments are also used on these machines.

There has been a demand for a transplanter which will successfully transplant plants as close as three, four, six or eight inches apart in the row. Under the method used with the horse-drawn transplanters this is not possible. There has been especially a demand from celery growers for a machine to transplant that crop. A celery grower in Ohio thinks he has solved the problem by the invention of a machine which is pushed along by the planter, marks the next row, opens the furrow to receive the plant and injects water into the furrow so that the roots of the young plants are set in moist soil. With this machine it is not necessary to deliberately mark the next row by hand, dig the hole and water the plants after they are set and continue to water them to keep them alive and perhaps replant a portion.

This machine consists of a wooden lead roller carrying the machine level and crushing any lumps which happen to be on the surface. Behind the roller is a pan or table to carry the plants. A tank is also mounted on the machine which is filled by means of a funnel on top. A tube extends to the rear of the machine and the row opening, and water can be supplied by the operator of the machine pushing on a spring valve with his thumb. There is a folding arm for marking the next row, which is adjustable from 7 to 64 inches in length with a disk fastened on the end. The lead roller may be adjusted higher or lower. The tank is also adjusted so that its weight can be shifted. Three row opening attachments are furnished with the machine which can be used for rows of different sizes and widths and for different plants.

In using this machine the operator places a bunch of plants on the table of the machine and adjusts the marker to the proper width of the row he wants. Of course, at the same time he has the proper row opener in place for the size of the plant he is using. The tank being filled with water, he pushes the machine forward with the centre of the funnel directly in line with the row. When he has pushed it as far as he can reach he takes up plants enough to fill the space of row

he has opened. Giving the plants a slight "flirt," he scatters them on the ground and then picks them up and places them in the furrow at the proper distances. As the operator moves along, a slight pressure thoroughly closes the dirt upon the roots. As fast as the plants can be separated, the operator can move along the row. The machine is said to push along easily with practically no resistance and cuts open a very neat place to receive the plants. The inventor says that with these machines he has been able to work in soil in which he could not have transplanted celery by hand.

IMPORTANCE OF SEED TESTING.

Seed testing by the grower before planting is important. It is even more important to secure small packages of the varieties wanted from the dealers and

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test their germinating power before purchasing large quantities. Although the seeds sold by reliable dealers do not vary greatly, yet there are sufficient differences worth taking into account before making extensive purchases. For example, seed of Danish Ballhead Cabbage received from over thirty growers and tested at the Pennsylvania Station ranged from 23 to 98 per cent. of total germination. The lot which ran 23 per cent. in the Geneva tester made an extraordinary poor showing in the field. The dealer from which this strain was purchased praised his particular type in the highest terms.

The viability of a seed is its ability to grow. That is, a seed may sprout but lack sufficient vigor to produce a plant, and such a seed could not be called viable.

Germination is not complete until the roots of baby plants have taken hold of the soil and are drawing nourishment therefrom.

The most certain and satisfactory way, therefore, to ascertain the viability of vegetable seeds is to plant them in soil under actual conditions rather than make sprouting tests in various devices. A little more trouble is involved, but the results are so much more reliable that it is far the best method. Use any fine garden loam which contains enough humus to prevent baking. Place the soil in flat or shallow boxes, being careful to firm the soil along the sides and in the corners. Use a straight edge to get a level surface and then firm the soil with a wooden block.

A piece of lath may be used to make furrows. The furrows should be about two inches apart and about one fourth of an inch deep for such vegetables as tomato, cabbage, pepper, eggplant, lettuce and most vegetables which are grown from small seeds. Sow two furrows of each variety, using 100 seeds in each furrow. Label carefully, close the furrows, firm the soil, water and place the box where the temperature will not be less than 70 degrees. This is too high for many vegetable seeds if the plants are to be retained for garden purposes. By counting the plants that grow, the germination percentage can be determined.

For a few seeds, the well known "dinner plate" tester, made with two plates and one or more moist strips of sterilized cotton goods, preferably cotton flannel will be found to answer the purpose.

When, however, it is desirable to make several germination tests at one time, or when many varieties are to be tested, instead of duplicating the plates already described, take a deep granite bread pan 6 or eight inches wide, in which is about one-fourth inch of water. Cotton flannel strips of any convenient length, two or three yards, and of the width of the pan are tucked cross-wise at intervals of five inches; short galvanized wires about an inch longer than the width of the pan are inserted through these tucks and gathered together, thus forming the cotton strips into numerous folds or loops which are suspended in the pan above the water by means of the supporting wires. The ends of the strips are left sufficiently long to touch the water in the pan. The entire piece of cloth, composing the loops, in which the seeds are placed is kept uniformly moist. The cloth should be moistened before the test.

A definite number of seeds taken as they come from an average sample is counted out for the germination test. For seeds in rather small lots, as garden seeds, 50 to 100 will answer, while for cereals, clovers, and other seed used in extensive cultural operations, about 200 should be used, and the tests duplicated when any doubt exists about the results. The tests should be examined from day to day, and the sprouted ones removed and counted, the number being recorded on a sheet of paper. The amount of time required for germination is dependent on several factors, such as moisture, temperature, vitality, and varietal differences, six or eight days being sufficient for most kinds. When tests are made during the winter or early spring months, at which time it is most convenient, the germination should be conducted in a moderately warm room, so that the temperature will not fall below 50 degrees at night and remain between 70 and 80 during the day.

For field corn take five kernels at random from each ear, marking the ear so that it can be easily located after testing. A shallow box, containing moist sand, will make a convenient tester.

STORING CROPS.

The great essentials in storing crops are, first, well grown and in most cases well ripened produce; second, careful handling and packing during the process of taking up and storing; third, proper conditions during storage.

In order to get the maximum results from storing any crop it is essential to have the crop well grown. In all cases, with the exception of tomatoes, celery and the like, which of necessity must be placed in storage in an unripe state, the produce to be stored should be ripe and sound.

Too much stress cannot be put upon careful handling of any crop to be stored and during storage. Each bruise or cut gives the proper conditions for the development of disease and if rough handling is permitted we are sure to find decay starting from such places, eventually infecting the whole crop.

Each variety of crop requires a different method of storage. Onions need a cool, very dry place. They may be stored in crates leaving aisles and air spaces, or they may be placed on slatted racks in a dry shed or storage house. The temperature should be kept as uniform as possible by ventilation and it should not go below 32 degrees.

Squash and pumpkins need a fairly warm, very dry place. About 50 degrees is the right temperature and it should not vary to any extent. One method of storing squash and pumpkins is to place them on racks two or three deep where some of the heat rising from the boilers keeps them warm and fairly dry.

Cabbage, if stored in a cellar, should be on shelves or racks. The storage cellar should be well ventilated so that cold air can be let in during the night and warm air kept out during the day. Condensation should be prevented by proper ventilation and, when occurring, it should not be allowed to drip on the cabbage. The temperature should be kept as uniformly low as possible without danger of freezing. Cabbage can also be successfully stored in pits with or without the roots on or in barrels placed horizontally and banked up with earth. Cabbage, when properly stored and sold during February and March, usually pays well for all extra labor.

When celery is stored in the field the trenches are made wide enough to accommodate 4 to 8 plants, 6 to 8 inches deep and as long as desired. Boards are placed against the sides of the trench and the celery is packed between them. As the trench is filled up the boards are pulled up until they meet, forming an inverted trough which sheds rain and makes an air space above the celery. Earth is thrown up to the celery and straw, marsh hay or litter is placed over the tops of the boards, more being added as the weather becomes more severe. The advance in price for stored celery is usually enough to cover all expense of storing.

Tomatoes can be stored at times to advantage by using an ordinary hot bed. Straw is placed on the bottom of the bed to the depth of a foot and the tomatoes are packed in carefully upon this and covered with clean straw or hay. The bed should be covered with a tight sash. Tomatoes can be kept in this manner for several weeks.

In storing root crops, fresher looking vegetables are obtained by storing in pits than in any other way, although they can be kept in a root cellar with a layer of earth over them to prevent evaporation. A good root cellar is of value, as crops are easily handled and are easily gotten at.

At the Ontario Horticultural Exhibition.

DISINFECTING SEED POTATOES.

With the steady spread of potato disease, no one who is buying new seed should think of planting it without soaking it in a solution of formaldehyde—one pint of the 40 per cent. solution of formalin to 30 gallons of water. Soaking the seed tubers for two hours will kill the spores of the scab and any other disease spores that may cling to the surface. The worst diseases the grower has to control will usually live over the winter in the tissues of the seed tubers themselves, and can not be killed by surface soaking. But the getting of the outside of the tubers free of all disease spores is the first step. When the tubers are cut each man cutting should have two knives, and when a tuber is cut into which shows any discoloration of any sort, it should be thrown away and the knife disinfected before cutting another tuber. A pint glass preserving jar is used by each man cutting, in which he makes a strong solution of formaldehyde. When a doubtful tuber is cut into, the blade of the knife is dipped into the glass jar and left, the second knife being used until another diseased or doubtful tuber is cut into, when that is dipped into the jar and the first knife used again. While some diseased tubers will get by, even with this caution, if this practice was general, the most of the diseases potato growers now have to contend with would disappear. The cost of this method is but a trifle above the actual cost of the diseased tubers thrown away, and as a diseased tuber is usually no good itself as a producer, and is actually a menace to those not diseased, one had far better throw them away in the beginning, even if they have cost good money. If the cover is kept on the glass jars when not needed to disinfect the knives, one mixing of a solution will hold its strength for several days, especially if the rubber band is on the jar so that it will be air-tight.

LIME-SULPHUR NOT A SATISFACTORY SPRAY FOR POTATOES.

From a spraying test made at the New York Station, in 1911, the conclusion was reached that "lime-sulphur cannot replace Bordeaux mixture as a preventative of potato diseases." A similar test made in 1912 strengthens this conclusion. The lime-sulphur treatments caused dwarfing of the plants as in 1911, did not repress, but seemingly increased, the damage from tip burn, did not keep off flea-beetles, apparently did not check late blight and rot, and resulted in greatly decreased yields as compared with rows sprayed with Bordeaux mixture.

The rows under test were arranged in sections, as in other potato-spraying work at the station. The first row in each of the five sections was sprayed with Bordeaux mixture (6-4-50), the second row with concentrated lime-sulphur solution diluted to give the standard strength for foliage (1 to 40), and the third row was left untreated. Potato beetles were combated by the use of arsenate of lead, and were well controlled on all rows.

Flea-beetle injury was slight, but decidedly least on Bordeaux-sprayed rows; tip-burn appeared in August and affected the checks and lime-sulphur rows badly, the latter much the worst, so that nearly all the plants on the lime-sulphur rows were dead several days before very many had died on the check rows, while the plants sprayed with Bordeaux showed little of the trouble at any time; dwarfing of the plants treated with lime-sulphur was noticed by August 20 and the difference in size grew more pronounced as the season advanced; late blight appeared very late in this field, the attack not being noticeable until most of the plants on the

lime-sulphur rows were dead from dwarfing and tip burn, so that the subsequent rot did less harm on these rows than on the check rows owing to the few living blighted plants to serve as centres of rot infection.

The check rows yielded at the rate of 240½ bushels to the acre, of which only 165 bushels were marketable owing to the large amount of rot. The lime-sulphur rows gave 39 bushels less of total yield than the checks, but, because rot had not spread so fast, gave a slight increase (6 bushels) in marketable tubers; and the Bordeaux-sprayed rows outyielded the checks by 18 bushels in total product and 111½ bushels in marketable potatoes.

CONCRETE HOTBEDS AND COLD FRAMES.

Many gardeners have used concrete for making permanent hotbeds and cold frames. The following description is of a four-sash bed, but of course any size desired can be built.

Lay out the bed 6 feet 8 inches wide by 12 feet 10 inches long. The concrete walls are 6 inches thick. Dig the foundation trenches 2 feet 6 inches deep within the lines given above. Make forms of 1-inch lumber to carry the south (front) wall 6 inches and the north (back) wall 14 inches above ground. Forms are not required below ground level. The tops of the end walls slope to the others. Before filling the forms with concrete, test the dimensions of the bed by means of the sash. See that the sash laps the forms 2 inches on all sides.

Mix the concrete mushy wet in the proportion of 1 bag of Portland cement to 2½ cubic feet of sand to 5 cubic feet of crushed rock, or one bag of cement to 5 cubic feet of bank-run gravel. Fill the forms without stopping for anything. Tie the walls together at the corners by laying in them old iron rods bent to right angles. While placing the concrete set ½-inch bolts of about 2 feet apart to hold the wooden top-framing of the bed to the concrete; or make grooves in the top of the concrete for counter-sinking the sash to the level of the walls with an allowance of one-quarter inch for clearance. This can be done by temporarily embedding in the concrete wooden strips of the necessary dimensions.

During this operation, by means of blocks nailed to the strips, make provision for the centre-bars described below. Remove the strips as soon as the concrete stiffens. Take down the forms after five days. The extra 2⅝ inches in length of the bed is allowance for the three centre-bars between the sash. These sash-supports are of dressed 1-inch stuff, shaped like a capital "T" turned up side down. The length of the stem of the "T" is equal to the thickness of the sash, and the top is 3 inches wide. Sufficient materials for the concrete will be supplied by 14 bags of Portland cement, 1¼ cubic yards of sand and 2½ cubic yards of crushed rock; or 14 bags of cement and 2½ yards of pit gravel at a cost of $10.00.

FORCING ASPARAGUS.

Sometimes asparagus is forced by placing frames covered with sash over the plants in the field, the rows of asparagus being set rather close together. This is considered a profitable method by many market gardeners.

Another method of forcing asparagus in the field is to dig ditches between the rows and fill them with fermenting manure. The surface of the bed may also be mulched with manure. Sometimes brick tunnels are laid between the rows and hot water pipes placed inside them to furnish the heat.

RULES AND REGULATIONS FOR FIELD CROP COMPETITIONS CONDUCTED BY THE ONTARIO VEGETABLE GROWERS' ASSOCIATION, 1913.

1. Field Crop Competitions will be conducted by the members of the Ontario Vegetable Growers' Association in the following classes of vegetables:—Onions, Tomatoes, Celery. The onions may be of any color and must be grown from seed but NOT TRANSPLANTED.

2. The Province is to be divided into four districts as follows:—

District No. 1: Ottawa, Kingston, Picton and Belleville.

District No. 2: Toronto, Dunnville, Simcoe and Hamilton.

District No. 3: London, St. Thomas, Aylmer West, Woodstock and Brantford.

District No. 4: Sarnia, Blackwell, Stratford, Ojibwa and Tecumseh.

3. The members of the Branches in each District will compete among themselves for the Field Crop prizes offered in their District.

4. The plots entered for each of the above named vegetables must not be less than one quarter of an acre.

5. There must be not less than ten entries in each class of the above named vegetables from each District.

6. Members can compete in one, two, or all of the three crops mentioned.

7. This competition is limited to the first thirty members making entry from each District, and entries will be accepted in the order in which they are received by me from the Secretary of the Branch.

8. The entrance fee will be One Dollar for each crop.

9. All prize winners in the Field Crop Competitions must compete for the large prizes offered at the Canadian National Exhibition, Toronto, the Central Canada Exhibition, Ottawa, and the Western Fair, London, this fall.

10. Secretaries of Branches whose members are desirous of entering the Field Crop Competitions, must notify me promptly and forward the individual entries, carefully filled in with name, Post Office address, Township, Concession and Lot, on or before the 15th day of May, 1913, accompanied by entry fees for same. Entry Forms will be supplied to Secretaries of all Branches.

11. Secretaries of each Branch must notify the undersigned at least one week before the crops are ready to be judged.

12. Judges will be supplied free of charge by the Ontario Department of Agriculture.

13. The following are the prizes offered in each District for each of the three crops of onions, tomatoes and celery:—

1st $25; 2nd $20; 3rd $15; 4th $10.

14. The following prizes are to be offered for each crop at the Canadian National Exhibition, Central Canada Exhibition, and Western Fair open to the prize winners in the Districts (in onions, in tomatoes and in celery):—1st $10; 2nd $8; 3rd $6; 4th $4; 5th $3; 6th $2; 7th $1.

15. Express charges on the prize winning vegetables entered at the Canadian National and Central Canada Exhibitions, and Western Fair, will be paid by the Ontario Government.

16. As the number of entries from each District is limited, members wishing to compete must act promptly.

J. LOCKIE WILSON.

FIFTH ANNUAL REPORT

OF THE

ONTARIO

Corn Growers' Association

1912

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO)

PRINTED BY ORDER OF

THE LEGISLATIVE ASSEMBLY OF ONTARIO

TORONTO:
Printed by L. K. CAMERON, Printer to the King's Most Excellent Majesty
1913

Printed by
WILLIAM BRIGGS,
29-37 Richmond Street West,
TORONTO

To His Honour Sir John Morison Gibson, Knight Commander of the Most Distinguished Order of St. Michael and St. George, a Colonel in the Militia of Canada, etc., etc., etc.,

Lieutenant-Governor of the Province of Ontario.

May it Please Your Honour:

I have the pleasure to present herewith for the consideration of your Honour the Report of the Corn Growers' Association for 1912.

Respectfully submitted,

JAMES S. DUFF,

Minister of Agriculture.

Toronto, 1913.

OFFICERS FOR 1913.

Honorary President ..... J. H. Williams, Fletcher
President ..... Byron Robinson, Wheatley.
First Vice-President ..... R. W. Knister, Comber.
Second Vice-President ..... Lester Gregory, Darrell.
Treasurer ..... J. H. Coatsworth, Kingsville.
Secretary ..... W. E. J. Edwards, B.S.A., Essex.

Directors.

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Jas. P. Chinnick, Chatham.
A. R. Everitt, Chatham.
David Wilson, Morpeth.
Ernest Gosnell, Highgate.
Dan. Buchanan, Thamesville.
Geo. Langford, Kent Bridge.
Fred. W. Pugh, Darrell.
W. H. Winters, Dover Centre.
A. G. Tisdelle, Tilbury.
T. G. Breen, Comber.
B. R. Cohoe, South Woodslee.
K. J. Wilson, Essex.
Peter McKinley, Tecumseh.
Jas. McAuliffe, Maidstone.
Jose Marentette, Jackson's Corner.
Patrick Coyle, R.R. 4, Auld.
Jas. Martin, Amherstburg.
T. H. Adams, R.R. 2, Essex.
John Arner, Arner.
Ray Jackson, Cottam.
H. P. Jeffrey, Blytheswood.
R. L. Moorehouse, B.S.A., Cairo.
John Hunter, R.R. 3, Petrolia.
Peter McVicar, Rodney.
Frank Silcox, B.S.A., Iona.
L. D. Hankinson, Aylmer.

TREASURER'S REPORT.

For the year ending in February, 1913.

Receipts.		Expenditures.	
Balance on hand from last year	$230 89	Cash paid out in prizes	$1,043 50
Legislative grant	500 00	Printing	529 81
Essex County grant	250 00	Expenses of directors and local judges	386 84
Kent County grant	200 00	Freight, cartage, express, etc. .	86 25
Municipal Grants	445 00	Advertising	91 57
Membership fees	355 50	Membership buttons	33 00
City of Windsor, grant in cash.	200 00	Postage	75 55
Building for Exhibition, shelving, light, fuel, etc., furnished by Windsor	300 00	Entertainment for evening meeting at Windsor Exhibition ..	35 00
H. Walker & Sons, grant for 2 years	200 00	Expense and services of judge and lectures at Exhibition ..	170 00
Cash donations	92 00	Corn bought for display at Guelph and Toronto, and class work at Windsor	34 50
Advertising in prize list	281 50	Refund of municipal grant	13 00
Space in Exhibition building sold	77 00	Secretary	50 00
Corn sold	8 50	Treasurer	50 00
Interest	6 11	Stenographer	25 00
Incidentals	1 20	Auditors	4 00
		Exchange	3 48
		Shelving, building for Exhibition, light, fuel, etc., furnished by Windsor	300 00
		Incidentals	23 90
		Balance on hand, June 6, 1913	192 40
Total Receipts	$3,147 70	Total	$3,147 70

Examined and found correct.

B. A. Smith,
Philip C. Fox. } *Auditors.*

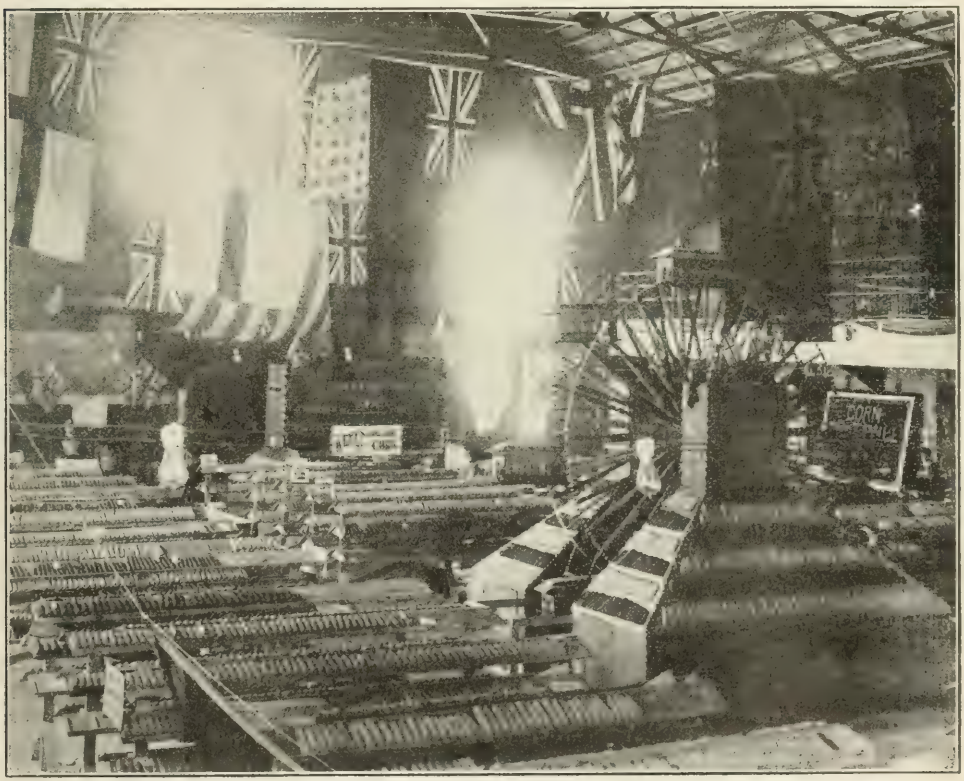
Essex, June 6, 1913.

J. H. Coatsworth,
Treasurer.

Ontario Corn Growers' Association.

ANNUAL CONVENTION.

The Fifth Annual Exhibition and Convention of the Ontario Corn Growers' Association was held in the armouries, Windsor, on February 11-14, 1913. There was a large increase both in exhibits and in the attendance. Six hundred and forty exhibited corn in the different classes, while the attendance was estimated at fifteen thousand.



A corner of the Ontario Corn Show held at Windsor, February 11-14, 1913.

A large number of interesting papers were given. In addition to those contained in this report instructive addresses were given by Hon. Jas. Duff, Hon. J. O. Reaume, Dr. G. C. Creelman, O. J. Wilcox, M.P., Col. E. J. Wigle, J. H. Smith, John Miner and others.

ADDRESS OF WELCOME.

HENRY CLAY, MAYOR, WINDSOR.

I am pleased to extend a welcome to the Corn Growers' Association to the city of Windsor. It is fitting that such a splendid exhibition should be held in this city which is the centre of the great corn growing district. Windsor is a city that is making more progress and less noise than any municipality in the Province. The corn growers of Essex have shown by this exhibition that great advancement is being made in that branch of agriculture. The land is well adapted and the farming is improving. The city has welcomed the Association by giving a considerable grant of money, and providing all the fixtures and accommodation for the show. The show is so much larger than any one expected that the accommodation, great as it is, is hardly sufficient for the purpose. I hope that you will continue the good work, and I assure you as Mayor of the City that you are at liberty to do as you please and our citizens will individually and collectively extend to you the heartiest welcome.

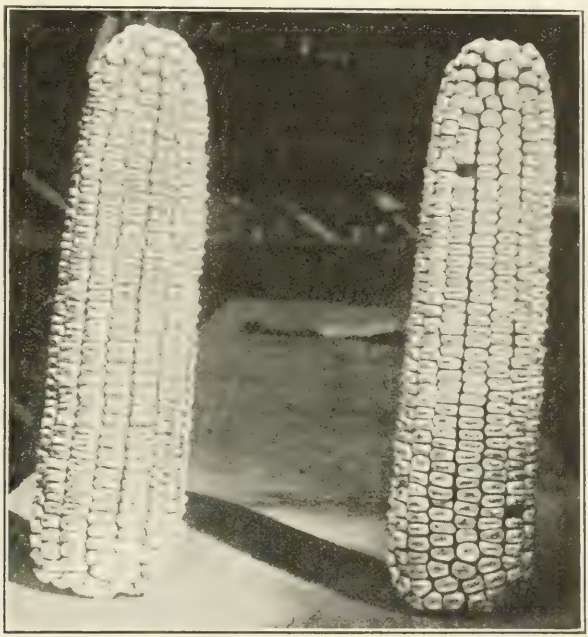
THE PRODUCTION AND REGISTRATION OF SEED CORN IN CANADA.

L. H. NEWMAN, B.S.A., SECRETARY CANADIAN SEED GROWERS' ASSOCIATION, OTTAWA.

I can assure you that it gives me very great pleasure to once more be with the members of the Ontario Corn Growers' Association, and to witness the wonderful progress that has been made in the growing of better corn since this movement was first inaugurated. I remember very clearly the situation in this part of the Province eight or nine years ago. At that time comparatively little attention was paid to the hereditary qualities of the corn plant. Corn was just corn. If the seed planted succeeded in producing a good crop, well and good. If it failed there seemed but little recourse. It was about this time that the Canadian Seed Growers' Association was organized with headquarters at Ottawa with a view to stimulating, through organized and systematic effort, a greater interest in the study and improvement of all the leading field crops of Canada, including corn. I am here to-day as secretary of that Association to explain to you the relationship between your Corn Growers' Association and our *Dominion* Association, and to point out to you the advantages which may accrue to both through close co-operation.

The work of the Canadian Seed Growers' Association extends in two directions. First towards the actual improvement of the type worked with, especially in the case of such plants as corn, and secondly towards the commercial exploitation of these improved types. Improvement is sought by means of a definite system of selection of seed ears which each member is required to follow under the direction of the Association, not one year or two years but so long as he continues a member. Starting at the beginning the mother ears are planted on a special seed or "breeding plot" away from all other varieties, each single ear planting a single row. This is the well-known "ear-to-the-row" method. The minimum size of the plot is twenty rows with 50 hills in a row. It is only necessary to insure having twenty

choice ears of desirable parentage for each year's plot, and it is in the care which is exercised in choosing these ears that the grower exercises his skill. Those who are making the greatest progress at present, follow strictly the recommendation of our Association by making a discrimination first of all between the rows. From the best rows the special ears are then taken. Several other matters such as cultivation, rotation, etc., are naturally considered, but I shall not take up your time to review these in detail to-day. Growers applying for membership in the Association are supplied with full directions as to how to proceed throughout the year, and are invited to correspond freely as to all matters of detail regarding which they may not be clear.



Champion single ears at Ontario Corn Exhibition, Windsor, 1913.

The utility of this method of selection has been amply demonstrated during the seven years in which seed corn plots have been grown under our direction. We have found the productive power of different ears to vary to a marked degree. This variability is illustrated diagramatically on page 29 of our special booklet entitled "The Canadian Seed Growers' Association and Its Work," copies of which booklet are available for free distribution to those desiring them. An examination of this diagram will show that row No. 11, the lowest yielder, produced only 95 lbs. of corn, while row No. 9, the highest yielder, produced 335 lbs., or nearly four times as much. A further study of this diagram will reveal other interesting facts. For instance we find that row No. 8 yields only 170 lbs. or, practically one-half of row No. 9. We may not be able to raise the average yield to that of row No. 9, but we certainly can bring it up much higher than is shown in this plot by reducing the proportion of low yielders, and taking ears only from the best. This is the first problem of our Association, and it is one which we believe can only be solved by constant attention to details over a series of years. Growers are advised to choose

a definite type, and to adhere rigidly to that type from year to year. It is only in this way that a given type can be standardized and can establish its reputation. This variability in corn in strikingly amplified in the great multiplicity of types which is to be found at your exhibition here, there being almost as many types as there are growers. The reason for this of course is clear. John Smith sets up for himself a certain type as an ideal, and always selects ears which come nearest that ideal. Jones, out on the base line, however, has his particular idea of what the type should be, and he selects accordingly, gradually developing quite a different type, although both perhaps may belong to the same variety. The number of different types of White Cap Yellow Dent corn, for example, are well known to most of you here. It seems to me highly desirable that there be a greater unanimity in regard to type of corn. It is quite possible that certain types may do better on some farms than on others, but I am strongly inclined to believe that the difference is too often exaggerated. From a commercial standpoint—and this brings us to the second phase of the work of our Association—it is most important that the number of types and varieties be reduced to the minimum, that this reduction be based upon actual field tests conducted locally under a competent man, and that the surviving types be very clearly and concisely described. In catering to the market for seed corn in Eastern Ontario and Quebec you must aim to supply an article most suitable for ensilage purposes. A corn which, grain and fodder considered, will produce the greatest amount of milk or beef per acre as the case may be is what is wanted. Such varieties as White Cap Yellow Dent, Early Leaming, and Bailey have proven quite satisfactory providing the type is not too large, the vitality good and the stock from which it came of good breeding. An attractive sample, even though of good vitality, cannot be expected to give good results if it came from mongrel stock. The inability of growers to procure well defined types of corn possessing a high degree of constancy has, I believe, told greatly against the more successful growing of this crop in Eastern Ontario and Quebec. In these districts the majority of farmers who grow corn for ensilage purposes prefer to grow dent varieties rather than flints, believing, and I think they are often correct, that the former varieties will give them greater food value per acre. Seed of the dent varieties cannot be properly matured in the east, so that growers are obliged to look to south-western Ontario for their supply. Sometimes they are successful in getting seed which gives good returns, and as a consequence they place their order with the same concern the following year hoping to get seed which will produce the same type as that which proved suitable under their conditions the year before, only to find that they have got something quite different. It would undoubtedly be a great boon to these districts and a great stimulus to corn growing generally were the eastern growers able to procure exactly the same type year after year. The Canadian Seed Growers' Association is aiming, among other things, to alleviate this difficulty by enlisting as breeders, farmers in south-western Ontario who are interested in this question, and who are awake to the commercial possibilities of it. All members follow a definite system as already mentioned. They are visited during the growing season by an expert who carefully examines their work, gives them all the information he can and scores their plots in accordance with a certain scale of points. These points are indicated in the following score card:

CANADIAN SEED GROWERS' ASSOCIATION.

SCORE CARD FOR STANDING SEED PLOTS OF SEED CORN

Name of Grower .....

Address, P.O. .....*Prov.* .....

Variety ..... *Type*..... *Color*.....

(Flint or dent)

Size of Hand Selected Seed Plot .....

Size of Improved Seed Plot .....

	Possible Score	SCORES AWARDED ON Hand Sel. Plot	SCORES AWARDED ON Improved Plot
I. Management of plot:			
(*a*) Size and arrangement of plot and method of planting	5		
(*b*) Method and thoroughness of cultivation ..	10		
II. Freedom from smut, rust and insects ..... (Names of diseases or insects found)	5		
III. Apparent yield and quality of fodder and grain considering:			
(1) Per cent. stand of crop..... (Reasons for any peculiarity of stand)	5		
FODDER.			
(2) Type of plant, considering height, character and strength of stalk, degree of suckering, average number leaves per stalk, character of leaf	10		
(3) Vigor of growth ..... (Reasons for any peculiarity of vigor)	5		
(4) Uniformity in vigor of growth	5		
PRODUCTION OF EARS:			
(5) Absence of nubbin producing plants	7		
(6) Absence of barren plants.....	8		
(7) General type of ear and kernel.....	5		
(8) Uniformity in type of ear and kernel.....	5		
(9) State of maturity ..... (Reasons for any peculiarity in maturity)	10		
IV. Purity of Variety: (Freedom from effects of cross fertilization)	20		
	100		

INFORMATION IN DETAIL.

	Stand: Average number stalks per hill.	TYPE OF PLANT. Stalks. Height.	Strength.	Character.	Height of ear from ground.	Leaves. Number.	Character.	Degree of suckering.	PRODUCTION OF EARS. Per cent nubbin producing plants	Per cent. barren plants.	State of maturity when inspected.	TYPE OF EARS. No. rows kernels.	Length of ear.	Circumference of ear.	Depth of kernel.	Shape of ear.
Hand Sel. Plot.																
Improved Plot.																

Variations in length and circumference of ears.....

Average length and circumference of ears .....

Distance of Plots from fields of other varieties .....

Suitability of farm for the production of high-class seed corn.....

Per cent. of stalks having tendency to produce more than one ear.....

Date of planting .....

General Remarks .....

.....

Date of inspection .....19....

(Signed).....

Inspector.

Grower's No. _____ *Certificate No* _____

Canadian Seed Growers' Association

Registration Certificate

for

"Registered Seed"

Kind _____ *Variety* _____ *Quantity* _____

This is to Certify *that the above mentioned quantity of seed, of the variety indicated, has been produced by Mr.* _____ *in accordance with the rules of this Association, and that the said seed has been recorded by the Association as* **Registered Seed** _____ *generations descended from* **Elite Stock Seed** *registered under Certificate Number* _____ *in the Year 19*.....

In witness whereof *the duly authorized officers of this Association have hereunto subscribed their names and caused the Seal of the Association to be hereto affixed at Ottawa, Ont., this*

_____ *day of* _____ *A.D. 19*.....

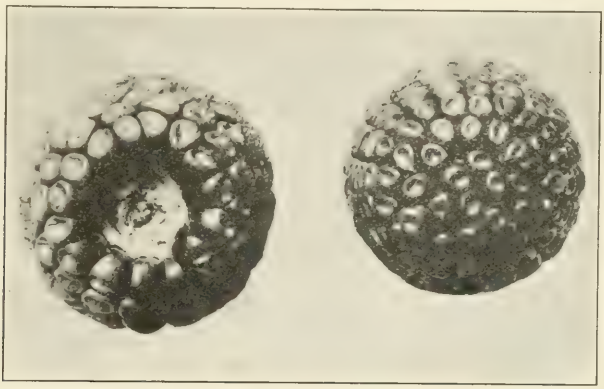
(SEAL)

President.

Secretary and Treasurer

After three or four years of careful work by the grower this length of time usually being required when the grower begins with an unselected sort, his corn may have reached such a degree of constancy, purity and general quality as to cause it to be accepted by the Association at Ottawa as *Registered Seed*, and recorded as such under number in the Records. A certificate is then issued to the grower certifying that his seed has been accepted in the manner described. This certificate may be used by him as he sees fit, and may even be reproduced in any advertising matter which he may publish.

Where the grower has a quantity of Registered Seed to sell it is catalogued for him by the Association, several thousand catalogues being printed and distributed widely.



A perfect butt and tip.

When orders have been received for all seed offered, or when all seed offered must not be held longer but must be shipped to the purchasers, an official, approved by the Association, goes to the grower's place of business and examines the contents of every package offered to see that no mongrel stuff is shipped. The germination of course is determined at an earlier date from samples sent to the laboratory. If the packages or sacks pass the final examination they are closed and sealed with the metallic seal of the Association, under which a tag is attached which bears certain information including the number of the certificate. Seed so sealed may pass through any number of hands and still retain its identity. We are able moreover to follow this seed to every purchaser through the statement of transfer which the vendor is requested to make, and thus to learn exactly how the different strains so distributed behave. From the foregoing it will be seen that the Canadian Seed Growers' Association may be regarded as the Bureau of Registration for plants for Canada, just as the Live Stock Records Branch, also located at Ottawa, is the Bureau of Registration for animals. The Records in both cases are entirely national in character, and may be accepted by any Province or any country which buys our seed. At present there is considerable interprovincial trade in seed grain and a little in corn. Growers in different parts look continually to us for information as to the source of high class seed being well aware that our system is designed to enable us to place our hands on large quantities for which we can vouch. Without such a system of inspection and close association it would obviously be quite impossible to vouch for seed and thus to give prospective purchasers the information which they value so highly.

We have quite a number of members growing corn according to our system in this part of the Province, but we would like to have many more. We like to have members grouped together in centres on adjacent farms and all growing the same variety or strain of that variety. The advantages of such an arrangement are numerous. It is only in this way, for example, that we can avoid contamination from other varieties since different varieties of corn cross very readily. Crossing in plants is spoken of by the scientist as *Vicinism*, a word derived from the Latin *Vicinus* or neighbor, and implies the influence of or contamination by other plants in the vicinity. This term might often be applied quite properly, I fear, to the evil effects which may follow from the careless methods of a neighboring farmer himself. I recall many instances where excellent corn fields have been ruined, in so far as their value for seeding purposes is concerned, by the contamination of pollen from neighboring fields of scrub corn. Under the present conditions of things it is not an easy matter to find many corn growers living together who will agree to grow the same variety, and in the absence of exact information such as can be obtained only by carefully conducted field tests as suggested, we can scarcly blame them. It seems very clear to me, therefore, that we must all get together on this proposition and work systematically and with a definite object in view. You have a strong organization here, and should be able to devise and carry through to a successful issue some general scheme which would place the commercial production of really high class seed corn on a high practicable basis. Speaking for the Canadian Seed Growers' Association I think I can promise you that it will do all in its power to assist you in this undertaking. Many of you are already growing excellent corn, but your work is not known outside of your own locality. Working independently moreover you are not able to obtain any sort of reliable official recognition for your product and cannot expect to obtain for it a price which it often deserves. This part of the difficulty can be overcome by joining the Canadian Seed Growers' Association and working under its direction. Any good corn grower may become a member of both the Ontario Corn Growers' Association and the Canadian Seed Growers' Association without adding very materially to the amount of work which he is already doing. Your local Association is doing a work which the Canadian Seed Growers' Association cannot hope to do in creating a general interest in the question of good seed and better crops as a whole. The Canadian Seed Growers' Association, on the other hand, is equipped and organized to do a work which you cannot do. It is quite clear that a National bureau of registration carries more weight with the buyer than would a local organization composed of officers who are very likely to have financial interests at stake.

In closing let me summarize the main points which I should like to leave with you. These are as follows:

First: it will pay every corn grower who produces his own seed to operate annually a special plot of about one-quarter acre as a source of supply of that seed rather than to depend upon good ears chosen indiscriminately from the main crop.

Secondly: there is a need and an opportunity for a number of the best growers to go into the production of high class seed corn in quantity under systematic expert direction and on a strictly business basis.

Thirdly: some definite action should be taken towards obtaining exact data concerning the relative merits of the different types now commonly grown in this part of the Province, and only the very best of these types should be retained and encouraged.

IMPROVEMENT OF STANDARDS BY BREEDING AND SELECTION.

Prof A. E. Chamberlain, Development Commissioner, G. N. Ry., St. Paul, Minn.

I am glad to be near my old home again, and to meet my old neighbors, and see the changes that have taken place. I have attended many corn shows during the past ten years, but this is the largest one I have ever seen. Corn has become of great interest in the United States, and they are still conducting a corn revival. If they can grow corn in North Dakota, South Dakota, Montana and Wisconsin, you people in these counties in south-western Ontario should be able to grow most excellent corn, and wonderful crops of it, as your soil and climate are particularly adapted to it. The farmer in the counties of Essex, Kent, Lambton, Elgin and a few others east of these should, in my judgment, make the growing of seed corn that is particularly adapted to planting for the growing of ensilage in the far eastern countries of this Province and in Quebec one of the leading features of his farming activities. When I go back to my home and tell them there about this corn show, they will scarcely believe me, as they think of Canada as a cold country of short seasons, the same as you think of our north-western United States.

You people in attendance at this show are as interested as any I have ever seen. You have in this Province one of the best Agricultural Colleges known anywhere. All of the speakers you have had thus far at this meeting have been good men, who know their business. Each one has told you something that will enable you to get a little more out of each hour's work you do in the field, first by increasing the yield per acre, and second, by improving the quality of your corn, thus enabling you to command a better price for it.

Not getting the best possible out of an hour's labor is a serious proposition. The man who gets only one-half what he should out of an hour's labor is, in one sense, only half a man, and the man who gets only one-fourth what he should out of an hour's labor is only one-quarter of a man.

Is there a man in the south-western part of Ontario who can tell what an acre of his soil, if properly tilled, will produce? Any successful merchant can tell you how much it is possible to make a dollar gain in his business, but I am unable to find a farmer anywhere who can tell me how much it is possible to produce from an acre of his land. It is simply because he does not consider science and get his head into the game. Farmers work hours enough, some of them too many hours. They work hard enough, and their families work hard enough, so far as physical labor is concerned. The trouble is that they forget that the gray matter stored in their heads is important in their work, and that it is impossible to get the best from their physical effort without its use. The Good Book says that a man shall earn his bread by the sweat of his brow; but the farmers as a rule, seem to forget that and try to earn it entirely by the sweat of their backs and other people's backs who work for them.

I would not attempt to speak before an audience of western Ontario farmers about the improvement of their stock, as I would about the improvement of corn and their field products. Almost any farmer in Ontario who has live stock is always trying to improve it. You are noted for that all over this country. But when it comes to the matter of grain and potatoes, too many of you fail to realize that exactly the same facts apply as to stock. It is much more important for you people to study the improvement of your grain than your live stock, for the reason

that you are so much further advanced in the quality of your stock than you are in the quality of the products of your fields. All that too many of you are doing at this time is waiting until the Agricultural College does something, or the seedsmen send you a catalogue with a new name in it. It is easy to get new names. The seedsmen produce a slightly different type of grain or potatoes, call it a new name, fix a fancy price for it, and many of you send them your good money for it while you have been raising the very same thing for years.

There is nothing grown upon the soil which it is as easy and simple to improve, and which can be improved so rapidly by the farmer himself, as corn. With it you can see all of the time just what you are doing, and you can improve it just as certainly and with just as good results as others if you will put your head to it.

What is a desirable seed corn? What kind of an ear must I pick out? It depends entirely upon where you live. You should not select the same ear in different localities. It should be a slightly smaller ear in the vicinity of Chatham than in the vicinities of Leamington and Essex. The biggest ears are never the best ears of corn in this northern climate. Corn is naturally a southern product. It requires a certain number of units of heat to mature an ear of corn of a certain size. If we are located too far north to be certain of nature furnishing us the units of heat necessary to mature a twelve ounce ear of corn, there is only one thing left for us to do. That is, not try to grow a twelve ounce ear of corn, but reduce the size to ten or eight ounces. The best ear of corn in any community is the ear of corn that will produce the most solid, thoroughly mature corn in a normal season. Many times more loss is sustained in the growing of corn each year from attempting to grow too large ears, which means too late maturing varieties or types, than from growing too small ears or types.

It is for this reason that home grown seed corn is always the most desirable when the crop is being grown for the grain it produces. The proposition may be different if the object is forage, but when corn is the object the best seed for any farmer in any country to plant in his field is the best seed that can be procured that has been grown in his locality and matured there for three or five or more years.

And this leads us to something else. We always know that the large ear of corn grows higher on the stalk than the smaller ear. There is a reason for this. It all comes from the system of circulation in the stalk of the corn, and what occurs there when that stalk commences to mature. But I have not time to go into that. What you want in south-western Ontario is an ear of corn that grows about the fourth joint, of varieties producing a normal stalk. You will find in the territory in which you people are interested, that an ear of corn that does not grow higher than that on the stalk will mature, I might say, every year. If you get it higher than that it will not always do so.

If any of you would go into your fields and for three years in succession select from your corn, if you are growing a pure variety, ears of a certain size and at the same stage of maturity at the time you select them, you would find that after three years of selection practically all of the ears of corn produced in that field would be of that size, and would mature at practically the same time.

Something else. If you will go into your fields each year for three years in succession and select each ear of your seed corn from the same joint on the stalk, say the fourth joint, you will find that after three years of such selection ninety per cent. or more of your ears of corn produced from seed selected in this way will

develop at the fourth joint of the stalk. You may take the third or the fifth or the seventh joint if you like. Ninety per cent. or more of the ears will develop at the joint from which you have selected the seed for three years in succession.

This is one way of procuring corn, or rather developing a strain of corn that will mature evenly and show marked uniformity in the character and size of the ears.

And it is not technical breeding. Technical breeding is something that means the detasseling of alternate rows, or crosshand pollenization. Neither of these is for the average busy farmer. You pay your Agricultural College and the men it employs in different lines, to do this work for you. It is interesting work and some of you "tired" farmers who have moved into town might devote a little of your surplus time to this line of work with interest.

It is enough, however, for the real active farmer to select his corn carefully along the lines I have indicated.

The shape of the ear is an important matter. This ear I hold in my hand shows it is degenerated. It is exceptionally large here at the butt, and tapers quite sharply to the point. That means that the kernels all around the upper end of this ear of corn are very shallow and small. If you examine the score card that is being used in this Show you will find it calls for an ear of cylindrical shape. That means it must carry its size well from the butt nearly to the tip. It should be practically as large up here one-third the length of it from the butt as it is at the butt. That means that each one of these kernels carries its thickness and its width and its depth well towards the tip of the ear. The tapering should commence very near the tip instead of being a gradual taper from the middle of the ear out. That means size and depth of kernel all over the cob, while the tapering ear means smaller and shallower kernels over more than half the cob.

In other words, you should have a cylindrical ear, because in that form only can nature store on the cob as much corn as should be there.

Then the score card tells you that there are a certain number of points for butts and a certain number for tips. These, too, mean more corn. Everything on the score card used by the judges in this Corn Show is there not from fancy or someone's notion, but because it means more corn, more product for the hour's work. The score card tells you, too, that the rows should be straight. The only reason for that is that neither man nor nature can put as many kernels of corn on a cob in any other form as in straight rows.

The most important feature, however, in the selection of corn, is its maturity. When the kernel of corn is developing, the first element that nature stores in it is starch. You always notice that if you get hold of a kernel of corn that is immature, it is nearly all this white floury element that you find inside. There is scarcely any of this horny material that we find so much of on a thoroughly mature ear of corn. Indications of immaturity are a breaking off of the tips of the kernels when you remove them from the ear, or maybe the other extreme, the sticking of the chaff to the kernel when you remove it. The covering has a wrinkled appearance. On the immature ear of corn many of the kernels when laid with the chit down, show a blistered appearance on the back. When you see any of these characteristics in corn it means a lack of protein and oil. Take a kernel of very immature corn and cut it crosswise with your knife, you will very often see even with the naked eye what looks like pores in the structure of the kernel. These are generally oil cells that are not filled. The oil is the last thing that nature deposits in the kernel of corn. And it is the oil content of the kernel that determines more

than anything else whether it is heavy corn or light corn. Corn devoid of oil has a reduced feeding value. Corn in which the protein content is not as large as it should be, has a materially reduced feeding value. And all immature corn is deficient in these elements.

The only way that the farmers in this or any other community or country can be sure that their corn will mature each year is by carefully selecting seed that thoroughly matures at the time in the fall of the year when they begin to fear they might have frost. And that seed must be selected each year in the community in which it is to be planted. Any other system than the careful selection of mature seed corn in the locality where it is to be planted, results in more or less fields of corn that do not get ripe, hence do not yield returns for the hour's labor spent in the field.

We have a great many so called varieties of corn. More than half of them are nothing more nor less than the result of selections such as I have described to you. We have not a great many varieties of distinct breeds of corn. But two men some time, some place, maybe far apart, had seed corn of a certain variety, possibly from the same field. Each planted it on his farm. When it came time to select the seed one selected one type of an ear, the other another. This was planted and re-selections made by each along the same lines. In the course of three or four or five years these two men had corn of distinctly different types, and very different characteristics. It was wholly the result of selection.

And you can do as much in the selection of small grains as in the selection of corn, and possibly more in the selection of potatoes than in the selection of either of these.

There is a wonderful difference in the power of different seeds to reproduce themselves. You all know what that means with your livestock. You all have at home the mare that raises a better colt than any other mare in the community, and the cow that raises a better calf, and the sow that raises a better litter of pigs. And these are not always the best individuals either. There is, however, something in the breeding that appeared in some former generation that does govern this whole matter both in animals and plants. We cannot always see it, if we do not know the history of the fore-parents back far enough. But nothing comes by chance through natural channels. There is a reason for every variation and every characteristic of the offspring either of animals or plants. We see this more clearly in potatoes. When you came home from the field last summer and your wife had surprised you with the first mess of new potatoes, what was the first question you asked her? It is always this. "How are they going to turn out?" And the wife nearly always makes one answer. She says, "There are some plants out there that have produced four or five nice potatoes, but a good many of them only have one big one, and a great lot of little ones that are too small to cook. If we get plenty of rain and the little ones get big we will have a good crop." The trouble is those little ones never get big. The result is the yield of potatoes is much smaller than it should be. It is not generally because the soil is not good enough, nor because you did not cultivate them enough, but simply because there were so many pieces of seed planted in the spring that did not contain that power to reproduce abundantly. Any farmer who has not done careful selection work with his seed potatoes can readily increase his yield one-half in three years, by simply going through the field in the fall and selecting for his seed only the potatoes from the plants that produced four or five nice even sized marketable tubers. That is the only way

known for certainly increasing the quality or the yield of potatoes. Of course I mean with an ideal seed bed and soil.

None of this work of selection is particularly laborious from a physical standpoint. It is simply a matter of a farmer getting his head into the game as well as his hands and his body.

THE FIVE SOURCES OF WEALTH.

Prof. A. E. Chamberlain, Development Commissioner, G. N. Ry., St. Paul, Minn.

We usually think of the sources of wealth as being four. The sea produces something like ten or twelve per cent. of the total wealth produced from natural sources each year. The mines have been the next greatest in importance, the forests next, and agriculture greatest.

Agriculture is by far the greatest *natural* source of wealth mankind draws upon. It is because of this fact that meetings of this character are being held in all civilized agricultural countries. It is because of the importance of agriculture as a source of wealth that we maintain our agricultural colleges, our agricultural county and district experts, and are agitating the teaching of agriculture in the rural schools.

I do not want in anything I shall say to-day to detract in the least from the importance of any of these four natural sources of wealth.

But it seems to me there is another great source of wealth, in fact as great as any of these, that we have shamefully neglected in all Anglo-Saxon speaking countries. I refer to human skill as the fifth great source of wealth.

We have had some wonderful men and women whom we have called geniuses simply because of things they have done that have seemed to almost surpass what is the natural conception of human ability. The Anglo-Saxon people have produced their full share of these great geniuses.

But success or greatness of a people does not depend upon surpassing genius or ability in the few. It depends upon the general average of the skill and ability of its people.

When I was a boy much of this country where we now are was covered by splendid forests. My father and myself used to go to the woods in the morning, fell a couple of splendid trees, and during the day chop them into cord word. We would take another day with a team and haul the wood to the market. We would probably get for the two trees, and our labor, $5 or $6 or $7. The trees were gone forever. The greater part of the great natural resources given us in the form of the forests has been disposed of in this or a still more wasteful manner.

A little later there came the saw mill into the community. We then felled the same trees and cut them into logs. We took them to the mill, which was simply an evidence of the development and exercise of a little higher skill, and there the same two trees were converted into lumber of a value of $15, $20, or $25. Nothing whatever had been added to what nature gave us except a little higher developed skill. And by the development of that skill the same natural resources afforded employment to a man twice or three times as long as when the trees were disposed of by the more crude method, and the produce was of three or four times the value.

A little later there came the furniture factory. It took the same trees and by the addition of a still higher development, human skill afforded employment to a human being for three or four months, and gave them a value of several hundred dollars.

If the German cabinet maker might have had one of the same trees he would have worked on it for a number of years, and given it a value of some thousands of dollars. No heavier draft on the resources nature gave us, but simply a higher development of human skill.

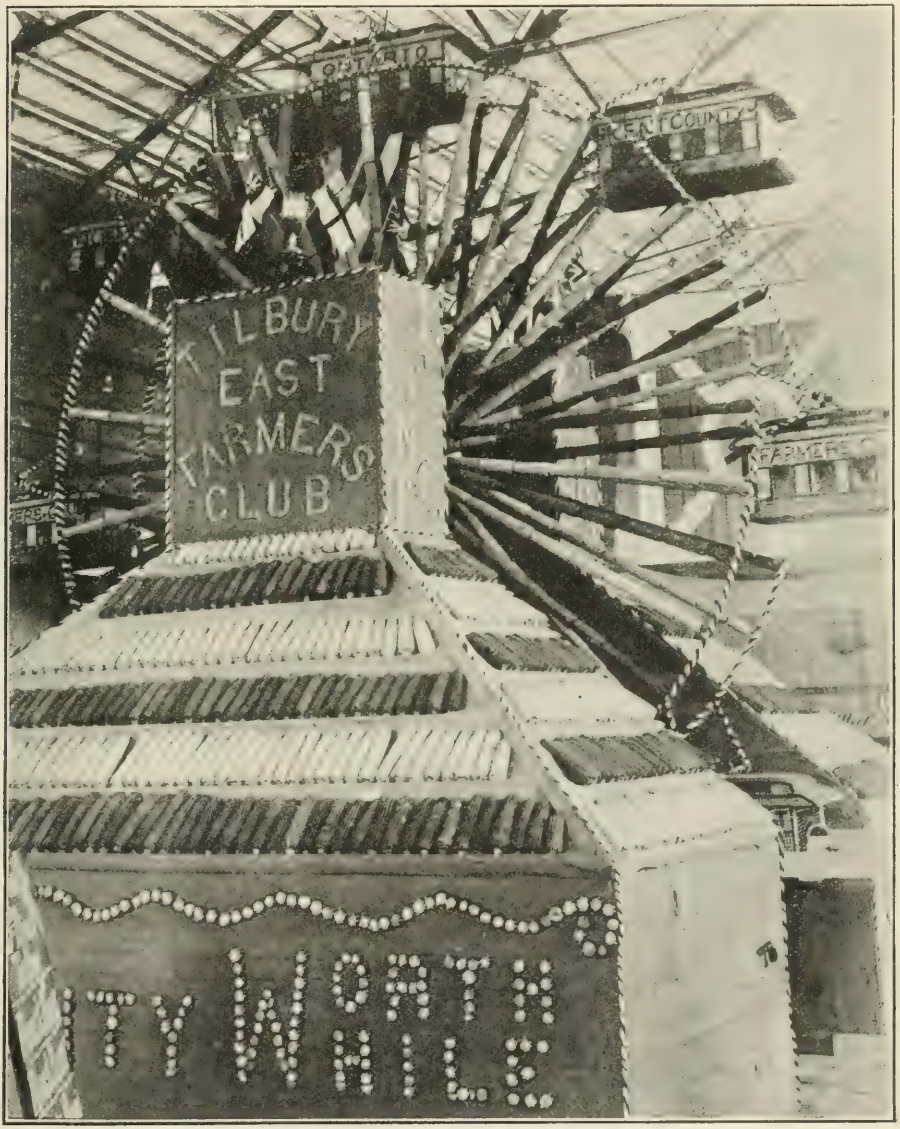
If the Italian wood carver might have had one of the trees, he and his family would have worked on it for nearly a generation, and would have given it a value of many thousands of dollars.

We are mining in northern Minnesota, and you will soon be mining in your north-west territory immense quantities of iron ore. Unskilled cheap labor works and sweats taking the ore from the mine. Other unskilled cheaply paid labor transports it from the mine to Pittsburgh. There other unskilled and cheap labor converts it into a product we call steel, which sells for one cent per pound. The German skilled mechanic buys some of our penny a pound steel, adds to it his skill and returns it to us and we pay him for it from $10 per pound, to more than $1,000 an ounce, in proportion to the skill that has been added to the original penny's worth of steel. No more of nature's resources used to afford the employment it does to the skilled German for months than were used to afford a fraction of a moment's employment to the unskilled laborer of America. But I presume that about now some of you are saying to me, "What has this to do with agriculture?"

Let us carry the matter a little further. You people grow oats. The skilled breeder of live stock and feeder of oats, a few of them in this country, a larger proportion in England and Scotland, and a still larger proportion in some parts of France and Belgium, buys from one of your farmers one-half of a bin of oats. He takes these oats to his barn and feeds them to a colt. When the colt is two or three years old, some of your or our farmers rush to buy him at $1 or even more per pound. The same farmer keeps the other half of that bin of oats at home and feeds them to one of his colts. If when his colt is three or four or five years old he sells him at ten cents per pound, he feels almost as though he had gotten the better of somebody. The dollar a pound colt is fed the same quality of oats, and the same character of grass and hay, and reared in the same style of a paddock and barn, but he brings the increased price simply because of the higher developed skill of the breeder and feeder.

On the Island of Jersey they maintain the year around one cow for each acre of ground, and that cow produces from 400 to 500 pounds of butter. Here in Ontario you use from three to five acres to maintain a cow a year on the ordinary farm, and they produce an average of about 175 pounds of butter each. It is just skill that makes the difference. Denmark, which is a little larger than the three counties of Essex, Kent and Lambton, supports a population of 1,250,000 people, and exported last year $101,000,000 worth of farm products,—pork, dairy and poultry products. They did so simply because of a higher development of the skill of the Danish people. They did it first by producing more per acre. Then they took the larger quantity of the raw product and manufactured it into a better finished product, or we might say marketed it in a better and more desirable condition. You may ship to London and Liverpool the same quantity of pork, dairy and poultry products the Danish people export, sell them the same day and on the same market, and the

Danish people will get for theirs approximately $8,000,000 more than you or any other people will get for theirs. This is not a matter of favoritism, but simply a matter of superior quality of the goods produced by a superior skill which has been drilled into their boys and girls since they were large enough to get out of the cradle. They do less talking than we do, but they do the real work. We have the



Tilbury East Farmers' Club Exhibit at the Ontario Corn Show, Windsor, 1913.

same opportunity they have, and in fact a much greater opportunity, but we fail to develop the human skill of the average man and woman to as high a point as has been done in so many of these foreign countries.

The greatest source of wealth Canada has to-day is the skill of her boys and girls and men and women if that skill is properly developed.

The reason your land is increasing in value is because your skill in handling it and marketing the product is slowly being developed. Ontario will lead this continent in the production of meat, dairy and poultry products and corn, if you continue the good work that you have in the last few years undertaken for the training of better farmers.

INVESTIGATIONS RE CEMENT TILE.

Prof. W. H. Day, Professor of Physics, O.A.C., Guelph.

To-day I am going to deal with cement tile more fully than I have done on any previous occasion. When cement tile first began to be talked of, a few years ago, I personally had no doubt as to their proving durable. However, it was only a short time until I received some literature upon the subject which claimed that cement was soluble in water and that therefore the cement tile when subjected to water passing through them continually would soon become so weak, owing to the cement dissolving, that they would crumble and thus become useless. This attack on cement was made by Messrs. Wheat Bros., Clay Tile Makers, of Emmetsburg, Ia. Coming from this source the attack was open to the suspicion that it might be biased, although their conclusions were based upon what at first appeared to be fair tests. First, small pieces of cement tile were placed in distilled water for a period of three days, and again for a period of four days, and they lost considerably in weight during each trial. The water was then analyzed, and it was found to contain silica, iron, aluminum, calcium, and sulphur, substances originally contained in the cement, and so it was proved that cement in these small pieces did dissolve in water. Similar tests were made with city water and solution also took place, though at a slower rate. In view of these facts we came to the conclusion that there was sufficient uncertainty as to the durability of cement tile for drainage purposes to warrant us in advising people to go rather slowly in the matter of adopting cement tile. At the same time, however, we began experiments of our own, which have now been going on for three or four years, and have enabled us at last to satisfy ourselves upon the subject.

We first took some small pieces of cement tile, similar to those used in the Wheat experiments just referred to, and placed them in distilled water. Some samples were left in distilled water seventy-three days and some one hundred and forty-three days, being taken out, dried and weighed from time to time during the test so that the loss or gain could be determined. Some of these same samples were placed in well water for a period of forty-seven days. We found the result quite irregular in both distilled and well water. Some samples lost continuously, some would lose for a while and then gain, and in those that lost continuously, sometimes there would be a loss that was inexplicably large. From the irregularities we came to the conclusion that some factor not being measured, possibly a change in temperature or possibly the frequent drying out to constant weight, was exerting an influence.

At the same time that these pieces of cement were being tested, a piece of clay tile of about average quality was placed in distilled water for forty-eight days and in well water for forty-seven days: in both cases the samples lost in weight. In the distilled water it dissolved more rapidly than any piece of cement tile tested, and in well water at about the same rate as some of the pieces of cement.

If the rate of solution in distilled water were to continue uniform, that piece of clay tile would have completely dissolved in four years, and in well water it would have dissolved in 58.3 years, but the rate of solution dropped in both the distilled water and the well water, and besides we know from long experience that clay tile in the ground will not dissolve in 58 years.

With the pieces of cement there was also a drop in the rate of solubility the longer the pieces remained in the water, and so from the irregularity of the solution and from the check piece of clay tile which was used, we came to the conclusion that the conditions under which these tests were made were so far from the actual soil conditions in which the tile would be placed that it was dangerous to draw from them conclusions as to the durability of cement tile.

Our next step was to take three cement tile made on the London two-piece machine (now taken off the market) and place them in running well water. The first sample was made by the dry process, the second sample also by the dry process, but considerably wetter than the first, and the third sample was made so wet that the tile stuck to the moulds and would not retain its proper shape when removed from them. These samples were left in running water for almost two years— 21½ months to be exact. They were weighed at the end of 7½ months, and then 3 months later, then 8 months later still; also again in 1½ months, and lastly at the end of 2½ months more. The first sample gained weight on each of the first four weighings, and lost on the last weighing, but the loss was only small compared with the previous gains. The net gain in weight was about 1-3 of 1 per cent. on the original weight of the tile. In the last 12 months the gain was 1-36 of 1 per cent. on the original weight, and in the last four months the gains equalled the losses.

The second sample gained on the first, second and fourth weighings and lost slightly on the third and fifth. The net gain in weight of this sample amounted to about 1-5 of 1 per cent on the original weight of the tile. In the last 12 months the losses exceeded the gains, the net loss being about 1-130 of 1 per cent of the original weight. In the last four months the sample gained slightly, the gain amounting to about 1-500 of 1 per cent.

The third sample lost weight on the first, second, third and fifth weighings and gained slightly on the fourth. The total loss amounted to about ¼ of 1 per cent. In the last 12 months the loss was 1-10 of 1 per cent., and in the last four months 1-25 of 1 per cent.

It is worthy of note that with No. 1 and No. 2, which were made dry, and were therefore more porous, there was a net gain in weight, and that with the more compact tile used in test No. 3 was a loss. Most people, I believe, would have expected that if there was any difference, there would be more loss in the porous tile than in the compact.

From the behaviour of these three samples we have been driven to the conclusion that in ordinary soil water there is no danger of good cement tile dissolving and crumbling, and consequently that cement tile properly made and properly cured must prove durable for drainage purposes, if strong enough to withstand the pressure in the earth. The strength of cement tile will be dealt with later. By properly made we mean of a strength not weaker than 4 to 1 of good cement thoroughly mixed, made as wet as the machine will work and firmly packed. By properly cured we mean not allowed to dry out rapidly during "initial set," kept moist for a week and then subjected to weather conditions until the tile are strong enough to handle without serious breakage. This method of curing, of course,

refers to cases where a steam curing plant has not been installed. Steam curing is much more effective and rapid. A day or two of steam curing will make the tile as strong as several weeks of the ordinary curing process.

The strength of cement tile was next tested. In July, 1912, we made by hand 5,000 3-inch and 1,000 4-inch cement tile on the Farmers' Cement Tile machine, which is a "hand machine." These were made as carefully and as well as we could make them. They were shaded from sun and sheltered from wind during the first twenty-four hours, so that this "initial set" was as good as possible. They were watered a week after being made and then stacked outside and allowed to cure during the remainder of the year. In January, 1913, forty tile of each size were broken in a crushing machine specially designed for the purpose. It was found that the average breaking stress of the 4-inch cement tile was about 837 pounds. In making this test the tile were laid on one plank, another plank was placed on top of them and the pressure applied to this top plank by means of a lever, so that you will see the pressure did not act all around the tile, but simply on the highest and lowest lines of the tile. In this position it took, as already noted, nearly half a ton to break the 4-inch tile. The lowest breaking stress for any tile was 561 pounds and the highest 1,435. The average thickness of these tile was 21-32 of an inch, their length 12.4 inches, and their weight 7 pounds 14 ounces.

By way of comparison forty 4-inch clay tile made at Port Dover were also tested. The average breaking stress was 1,170 pounds, or 333 pounds more than the average of the cement tile. The lowest breaking stress on the Port Dover clay tile was 663 pounds and the highest 1,597. The average thickness was 20-32 of an inch, being 1-32 less than the cement tile, the average length 12.67 inches, and the average weight 7 lbs, 5 oz.

The Port Dover tile being considerably thicker than some other makes of clay tile, it was decided to test some thinner ones, known to be giving good satisfaction; consequently thinner samples were procured from Kingsville, in Essex County. The average thickness of this tile was 15-32 of an inch, or exactly three-quarters the thickness of the Port Dover samples, and the average breaking stress was 827 pounds.

The length of these tile was 11.9 inches and the weight 5 lbs, 3 oz. The lowest breaking stress was 663 pounds and the highest 950 pounds.

The average breaking stress of the cement tile was 10 pounds more than that of the thin clay tile. It will also be observed that the lowest breaking stress in any cement tile was 102 pounds less than the lowest breaking stress of a Port Dover or Kingsville clay tile. Now just what the minimum stress allowable is we are not able to say, but one thing is certain, namely, that any of the clay or cement tile tested were strong enough to stand up against the earth pressure to which they would be subjected if placed in the ground. The lowest breaking stress applied along the top line of the tile was somewhat over 560 pounds, but if the pressure was applied all around the tile as it is in the earth, it would undoubtedly take many times that to break these tile.

At a depth of three feet, when the soil is so wet that it will flow like quicksand, the greatest possible pressure on the 4-inch tile is about 200 pounds on the whole upper surface of the tile, while the weakest tile tested required nearly three times this amount applied along one line to crush it. As a result of these tests of 4-inch tile we have come to the conclusion that the weakest of them were many times as strong as necessary to withstand the greatest pressure to which they would be subjected in soil conditions.

We next tested the breaking stress of some power made cement tile manufactured at Woodstock, the average thickness of which was 18-32 of an inch. They were thus a little thicker than the Kingsville clay tile, but thinner than those from Port Dover and also thinner than those made on the Farmers' Cement Tile Machine. The Woodstock tile were made of crushed stone and cement in the proportion of 3 to 1 on December 4th. They were given 48 hours steam curing and afterwards piled outside until January 16th, when they were shipped to us. From then until February 24th, when they were tested, they were piled inside. Thus they were about 2½ months old, but during half the time they had been kept dry inside, during which little curing took place. Their average strength was 791 pounds, the weakest tile requiring 543 pounds pressure and the strongest 956. However, only half of these tile were broken on February 24th; the remainder were put in a trough of water, where they were left for three weeks, at the end of which the average strength was 904 pounds, showing an increase in weight of 113 pounds. The weakest tile now required a pressure of 663 pounds to break it, and the strongest 1,079.

Part of the crowd at one of the Ontario Corn Growers' Association School Corn Shows.

Other sizes of both clay and cement were tested, giving about the same comparative results. By these tests of breaking stress we have established a second point regarding cement tile, namely, that if properly made and properly cured they are as strong as some well known and satisfactory makes of clay tile. Hence, we must conclude that cement tile thus made and cured are strong enough for tile drainage purposes.

The question is often asked, whether cement tile or clay tile are the more porous? In this form the question really has no definite meaning, because the porosity of clay tile varies a great deal; so also does that of cement tile; for instance, the average porosity of the Port Dover tile tested was 35.7 per cent., while the

porosity of the Kingsville tile was 23.8 per cent. A similar variation is seen among cement tile; for instance, the 4-inch tile made on the Farmers' Cement Tile Machine had a porosity of 27.8 per cent., while the Woodstock 4-inch cement tile had a porosity of 22.5 per cent. Power made cement tile manufactured at Marden (the proportion of the cement in the mixture not reported to us), had a porosity of 27.7, practically the same as the hand-made cement tile.

So far as the efficiency of drains is concerned, however, porosity is not a factor in underdrainage, because the water does not enter the tile through the pores, but through the joints between the tile. In order to have some definite figures on this point we selected 3-inch, 4-inch, 5-inch and 6-inch tile of both clay and cement, using two clay tile of each size and two cement tile of each size. Having our tile ready we sealed one end of each tile with pitch and then set each tile, sealed end downwards, in a crock of water and measured the amount of water that would pass into the tile through the pores. The experiment was repeated twice. The first test was run for one week and the second test was run for three weeks. In all cases we found that the water passed into the clay tile very slowly. The amount in the 4-inch Port Dover at the end of each test was just sufficient to nicely cover the bottom of the tile. This amount was measured accurately and it was found that if the water continued to go in through the pores at the same rate, it would take the first Port Dover tile 233 days to fill with water, and the second one 420 days. The first 4-inch Kingsville tile would have taken 20 days to fill and the second would have taken 42 days. When we remember that the Kingsville tile have a much smaller porosity than the Port Dover, we should have expected that the Kingsville tile would have taken much longer than the Port Dover to fill, whereas they took just about one-tenth as long in each case, so we see that the rate at which water will pass through the wall of a tile does not depend entirely upon the porosity. Cement tile were much more variable: for instance, one 4-inch tile made on the Farmers' Cement Tile machine had practically no water in it at the end of the test, while the other 4-inch made on the same machine filled in about 15 minutes. A similar variation was found in the power-made cement tile. The first 4-inch Woodstock tile would have taken 233 days to fill, while the second filled in 2 hours.

In examining the cement tile we observed that those which were practically as nearly water tight had been made just wet enough that the packer produced a sort of water-lime surface on the inside of the tile. The other sizes of tile behaved much in the same way as the 4-inch. From these percolation tests we may conclude that it would take a very, very long time for clay or cement tile to drain a field if we had to wait for the water to go in through the pores, hence we may conclude that porosity of the tile is not a factor in the efficiency of underdrainage. The only bearing of porosity is that it gives some idea of the strength of the tile, providing thickness, length and material are the same.

The rate of making cement tile by hand did not prove from our tests to be as rapid as is frequently stated. Two men working faithfully could not exceed a speed of about 400 tile per day. There is a power attachment for the hand machine by means of which a little gasoline engine can be used to turn it. We did not make any tile with the power attachment, but we have seen them made and noted the speed for a short time, from which it would appear that two men using a power attachment would probably make from three to four times as many tile as by hand.

The material required for 1,000 3-inch cement tile made of a strength of 4 to 1 is about 3½ barrels of cement and 2 yards of sand. For 1,000 4-inch it will require 4 barrels of cement and 2 1-3 yards of sand. Knowing the price of cement and sand in one's own locality one can arrive at the price of the material necessary for making 1,000 cement tile. And knowing the approximate rate at which they can be made and the price of labour in his locality he can calculate the entire cost, or if he can make the cement tile in his spare time he can calculate just about what wages he would be saving by making his own tile.

THE INFLUENCE OF GOOD SEED ON CROP IMPROVEMENT.

Prof. C. A. Zavitz, Ontario Agricultural College, Guelph.

We are pleased with the progress which Ontario has made along various lines of agriculture in recent years. The crop improvement of Ontario during the last twelve or fifteen years has been almost marvellous, and yet we are only on the brink of the possibilities along this line. I remember some eighteen years ago addressing a meeting in Eastern Ontaro when Mr. D. M. Macpherson drew particular attention to the fact that the farms of Ontario were not producing as good results at that time as they had produced twelve or fifteen years previously. We are delighted that a great change in this respect has taken place. The Bureau of Industries for Ontario has collected statistics on crop production in each of the past thirty-one years. If we divide the last thirty years into two periods of fifteen years each we find that for the latter as compared with the former period there has been an actual increase in yield of grain per acre of some of our principal farm crops as follows: Oats, 10.2 per cent.; barley, 20.1 per cent.; fall wheat, 11.1 per cent.; and corn, 6.8 per cent. These averages in increase in yield per acre if applied to the average value of the crops of Ontario for the past five years would mean an annual increase for the Province as follows: Oats, $3,846,505.27; barley, $2,251,657.07; fall wheat, $1,733,518.49; and corn for husking, $603,307.56. This makes a total of $8,435,018.39. This represents simply the annual market values of the increases of the four principal grain crops per acre when we compare the last fifteen years with the fifteen years previous. We have the earnest hope that the next fifteen years will show even greater increases in yields of crops per acre. In bringing about this increase in crop production the proper use of good seed will undoubtedly be one of the most important factors. In carrying this out the Agricultural Experiment Stations and the various organizations such as the Canadian Seed Growers' Association, the Ontario Corn Growers' Association, etc., and the individual farmers throughout the Province have their work to perform, each being greatly helped by the work of the others. We are glad to have with us at this Convention prominent men from three of the States of the American Union, for whose helpful assistance we are very grateful.

The three special points which I wish to touch very briefly at this time are variety, germination, and seed characteristics.

Varieties of Barley, Oats, Fall Wheat, Potatoes and Alfalfa.

When at my home on a two hundred acre farm in Middlesex county, where we grew practically all classes of farm crops, including from eight to twenty acres of corn annually, I did not consider that variety was a very important factor in

crop production. I did not know but what, possibly, one variety might give the best results in one year, and another variety in another year. After having studied many varieties, however, during the past twenty-five years, and having watched the records of some of these varieties under varying conditions for several years in succession, I am thoroughly convinced that much depends upon variety, and if we are going to secure the best results it is important that we secure the most suitable varieties for our own particular soils and conditions. If we did not have such strong faith in this work we would not spend so much time at the Ontario Agricultural College in trying to secure through importation, selection and hybridization the very best varieties for cultivation in Ontario, and then distribute the highest quality of seed of these varieties for experimentation and for cultivation throughout the various parts of the Province. Some of the most extensively grown varieties of farm crops in Ontario at the present time were introduced by the Ontario Agricultural College, and distributed through the medium of the Ontario Agricultural and Experimental Union. In 1912, upwards of 5,000 Ontario farmers co-operated in the carrying out of this experimental work. Permit me to draw your attention to a few of the most prominent varieties belonging to the five classes of farm crops referred to in the earlier part of this address.

According to information gleaned throughout Ontario in 1912 fully 94 per cent. of the barley which is grown in this Province is either the Mandscheuri or the O. A. C. No. 21. The Mandescheuri barley was imported by the Ontario Agricultural College in the spring of 1889. The seed was carefully selected and tested at the College in each of the five years. Its record for the five years' experiment was so good that it was introduced into the co-operative experimental work, and distributed throughout Ontario. This variety gave excellent returns throughout the Province also, and experimenters soon increased the seed, the variety rapidly entered into field cultivation and became a noted variety in Ontario, and spread from Ontario to other places. In 1903 we had a nursery plot of about 10,000 plants at the College. From this nursery plot fifty of the best plants were selected, and tested out separately. As a result of this work the O. A. C. No. 21 proved to be the most desirable variety. This was distributed in connection with co-operative experiments five years ago, and it is now increasing very rapidly throughout the Province. Practically all of the prizes which have been awarded to standing crops of barley in the field crop competitions of Ontario and in the threshed grain at the principal exhibitions during the last two years have gone to samples of the O. A. C. No. 21 variety. Of the twenty-eight entries of barley at the Provincial Winter Fair at Guelph in December last twenty-three were the O. A. C. No. 21 and four were the Mandscheuri variety.

Of all the grain crops of Ontario, oats are grown more extensively than any of the others. The market value of the oat crops of Ontario now amounts to about thirty-eight million (38,000,000) dollars annually, and yet there is room for wonderful improvement in this important cereal. We are growing decidedly too many varieties, and it is difficult for oatmeal millers and other buyers to obtain uniform samples. We have been looking for an oat which would be a leader in the Province. The Banner oat has been the most extensively grown variety, but it is rather thick in the hull, it does not yield enough per acre, and the straw is only of medium strength. The Siberian, which the College imported from Russia over twenty years ago, is the second most extensively grown oat in Ontario. It does

better in some localities than the Banner, but not quite as well in others. Ten years ago we had a hand planted nursery plot of over 9,000 plants of the Siberian variety. We selected some of the best individual plants, and have tested them out in the same way as we tested the plants of barley previously referred to. As a result of that work we found that the O. A. C. No. 72 variety gave us the best results. We sent choice seed of this variety to three hundred of our experimenters in the spring of 1911. When the returns were received in the autumn we found that the O. A. C. No. 72 had taken the lead throughout the Province. Many of these experimenters carefully saved the seed, and sowed it all in the spring of 1912. Although there is now a big demand for these oats those who have the seed are apparently holding on to it for sowing this year, and by next autumn I expect there will be a good supply of pure seed in Ontario. One man recently sold 100 pounds of this seed for $25.00. The O. A. C. No. 72 oats grow a good length of straw, are comparatively free from rust, and usually stand well. The grain is white in color, and is of good quality, being thinner in the hull than the Siberian, the Banner, the Lincoln, and many of the other varieties. We hope that this oat will prove of great service in Ontario.

Winter wheat, or fall wheat, is grown on about three-quarters of a million acres of land in Ontario annually, and the most extensively grown variety in the Province at the present time is the Dawson's Golden Chaff. In 1881, Robert Dawson had a field of the White Clawson wheat which was very badly lodged. When walking over the field Mr. Dawson found one plant which was standing erect, and it had a different appearance from the surrounding plants. He saved the seed of this one plant, and soon had enough for sowing in his own fields and for selling to his neighbors, who called the wheat "Dawson's Golden Chaff." Mr. Dawson's name soon became the household word throughout Ontario, and the wheat has become known in many places as a variety of very stiff straw, of beautiful appearance, and of high yielding qualities. Unfortunately, the grain is somewhat soft, and not as good a producer of flour for bread production as some of the other varieties. It is used very extensively in combination with the hard spring wheat of the West, and there has been a considerable demand for it for the manufacture of breakfast foods, biscuits and pastry. Some selections from the Dawson's Golden Chaff, such as the American Wonder and the American Banner, gave a slight increase in yield of grain per acre. All the highest yielding varieties of wheat in Ontario at the present time are of the Dawson's Golden Chaff type.

The annual market value of the potato crop of Ontario is about twelve million (12,000,000) dollars, while that of the husking corn is about ten million (10,000,000) dollars. We believe that the value of the potato crop would be greatly increased annually if the farmers would grow only a few of the very best varieties and pay more attention to the seed which they use. There are far too many varieties of potatoes grown in Ontario, in fact from enquiries which I have made in each of the past few years I have never had less than fifty varieties of potatoes mentioned as grown quite extensively in different counties of Ontario. I think it is very unfortunate that agents representing seed firms, particularly in New York State, are going through the Province from house to house, and from year to year, selling different varieties of potatoes in small quantities. It is practically impossible for the farmers to get anything but a local market for their potatoes. Buyers cannot get a sufficient uniformity of potatoes grown in the different sections to place in car load lots to ship to the larger markets. While it is true that it

requires a few varieties to meet the conditions of the different soils throughout Ontario, we believe that these varieties could be confined to a very small number. The Rural New Yorker No. 2 is the most extensively and the Empire State the second most extensively grown varieties in Ontario at the present time. Both of these are good varieties, especially the Empire State, but in a season like 1912 it is only an average variety in its resistance to rot. We have another variety of late potatoes, known as the Davies' Warrior, which we have been testing and selecting at the College for some time, and which is exceedingly promising. In seven years' experiments at Guelph it has given the highest yield per acre of all other varieties, and in the two years that we have used it in connection with the co-operative experiments over Ontario it has taken the lead in yield per acre throughout the Province. It is a white oval potato, which produces a large percentage of marketable tubers. In 1912, when the rot was so prevalent throughout Ontario, the Davies' Warrior was one of the three varieties of potatoes which was the least subject to the attacks of the rot. We expect to distribute this variety again this spring in connection with our co-operative experiments, and believe that before long it will be grown extensively throughout Ontario.

Alfalfa is now being grown successfully in nearly all counties of Ontario, and we believe that it will be grown much more extensively when peope realize the great value of this crop, and will use the proper methods for its cultivation. It is being recognized more and more as a most valuable crop for Ontario. Its perennial character of growth, its power of making use of the free nitrogen of the atmosphere, and of the fertilizing elements of the subsoil, and its capacity of producing large yields of exceptionally nutritious feed for farm stock, combine to place this crop as one of the most important which can be grown. It possesses a combination of characteristics which is not found in any other farm crop. Alfalfa starts its growth early in the spring, which continues throughout the summer and even late into the autumn. Under favorable conditions it produces two or three crops per annum, and thrives for several years without the necessity of re-seeding. The feed is relished by practically all kinds of farm stock. It can be fed in a green or in a dry condition, can be converted into silage, and in a few instances can be pastured at certain times. In at least some localities over Ontario the second crop in the season is allowed to ripen for seed production to good advantage. Alfalfa is particularly suitable for use in a long rotation, and leaves the soil in an excellent condition for the growing of other farm crops. In order, however, to make alfalfa growing successful it is important to sow the right kind of seed on suitable soil, and to employ the best methods of culture.

At the Ontario Agricultural College at Guelph during the past fifteen years we have obtained an average of three cuttings per annum, giving a yield of a little over 20 tons of green crop per acre, or of 4.8 tons of hay per acre per annum. We have had many experiments under way during the past fifteen years, and have now about 150 plots of alfalfa, besides many rows of individual plants in our plant-breeding nurseries. We find there is a wonderful difference in the hardiness of the various varieties. The Ontario Variegated alfalfa has in every case given us excellent results, while the Common alfalfa from the Western States has in every case proven unsuitable at Guelph.

The history of the Ontario Variegated alfalfa is very interesting. In 1871, Nehemiah Bethel, a farmer living in the Niagara Peninsula, went to New York for imported sheep, and secured from a French shepherd two pounds of alfalfa seed, which he sowed in a plot near his barn. The crop did well, and he obtained seed

and increased his area, and in 1878 he had a little less than ten acres from which he obtained about seventy (70) bushels of seed, a small quantity of which was sent to the Exhibition in Paris, and for which a diploma was granted. This alfalfa was evidently a cross between the Common alfalfa of commerce and the native yellow-flowered alfalfa of Europe. The same strain of alfalfa has now been grown in the Niagara Peninsula for upwards of forty years, and through natural selection has become quite hardy. Another importation was made by Dr. Colver, of Wellandport, in 1876 from Baden, Germany, which is said to be the home of the Grimm alfalfa of Minnesota. This evidently was also a Variegated alfalfa. Both the Bethel and Colver strains of alfalfa appear to be grown extensively in Lincoln and Welland counties. We examined about one hundred and fifty alfalfa fields between Sarnia and Niagara Falls in 1912, and found that nearly all of the Ontario Variegated alfalfa was confined to the Niagara Peninsula. Unfortunately, owing to the exceptionally wet weather in 1912, the Ontario alfalfa seed production proved to be a failure. We hope that in 1913 there may be again a good crop of seed as has been produced in each of a number of years past. According to our experiments at Guelph the hardiest strains of alfalfa are the Ontario Variegated, the Grimm alfalfa of Minnesota, the Baltic alfalfa of South Dakota, and the Sand Lucerne. Even the Turkestan alfalfa is more hardy than the Common alfalfa of Nebraska, Kansas, Colorado, Utah and even Montana, which to a large extent traces its history through California to Mexico and to Central America, where it was grown for many years after its introduction by the Spaniards. During this period evidently there was no opportunity for the tender plants to become killed, and as a result the crop is apparently quite tender and unsuitable for sowing in Ontario, although it has been shipped into the Province in carload lots, especially from the State of Utah. It will, therefore, be seen that variety, even in alfalfa, is exceedingly important if we wish to be successful with this important crop in this Province.

Surely sufficient has been stated to show that variety, as it applies to the five crops here referred to, is very important, and that the farmer should pay particular attention in securing the very best kinds in every instance.

Germination of Seed.—Although it is important to secure good varieties of farm crops it is also of great importance to use nothing but seed of high germinating power. In many cases in the past great losses have been sustained by using seed which is weak in vitality. Many germination tests have been conducted at Guelph from seed obtained from different sources and it was found that very frequently seed of fairly good appearance is low in vitality. This deterioration is brought about in various ways such as lack of maturity, sprouting at the time of harvest, injury during the process of threshing, the killing of the germs by winter frost, etc. Time will not permit dealing with this question fully, but as an illustration of the lack of vitality, which we frequently find in purchased seed, I wish to draw your attention to the results of an experiment which I conducted in the germination of mangel seed, as we found that there were many failures of the mangel crop throughout Ontario, which appeared to be from the lack of vitality of the seed.

Years.	Varieties.	Per Cent.
1909	Ontario Seed Company's Ideal	174
	Rennie's Perfection Mammoth Long Red	15
1910	Steigler's Yellow Leutewitzer	158
	Steele-Briggs Yellow Globe Selected	15
1911	Steele-Briggs Prize Mammoth Long Red	219
	Rennie's Yellow Leviathan	60
1912	Rennie's Perfection Mammoth Long Red	125
	Bruce's Gate Post Mammoth Long Red	125
	Metta's Yellow Eckendorf	35

In each of the past four years very careful determinations have been made in the field as to the percentage of plants produced from exact numbers of clusters planted under uniform conditions. This was an extensive experiment made in a definite way to determine the actual percentage value of different varieties of mangel seed obtained from different sources and in different years. In order to show the great variation of these results we simply here enumerate the extreme percentage of germination of the clusters of mangels of the different varieties tested in each of four years.

It will be seen that there is a very great variation in the germination of the clusters of mangels of the different varieties in each of the past four years. It is not a matter of variety, however, as the seed of the Rennie's Perfection Long Red, which was the lowest, with a germination of only 15 per cent. in 1909, occupied the highest place with a germination of 125 per cent. in 1912. It will be seen that it is not a matter of seedsmen, as the Wm. Rennie Seed Co. sold mangel seed which occupied the lowest place in germination in 1909 and again in 1911, and the highest place in 1912, and the Steele-Briggs Seed Co. sold mangel seed which occupied lowest place of all the varieties in 1910, and the highest place of all the varieties of 1911. The natural conclusion is that the mangel seed of any variety in the hands of any Ontario seedsmen may produce either a high or a low germinating power. The germination of the mangel seed has a much greater influence on the actual returns of a crop than many people realize. If we wish to grow mangels in Ontario with the hope of securing a good crop it is absolutely essential that we use seed of good vitality.

Every farmer interested in crop production should carefully study the Canadian Seed Control Act, which deals not only with the purity, but also with the germination of seed. If he would do this he would find the Act would prove of great assistance in securing seed of fairly good vitality. In addition to this, I would suggest that each man be careful to germinate small samples of the seed before the crops are sown in an extensive way, and thus prevent many partial failures.

Seed Characteristics.—Not only is it important to secure varieties of seed which will germinate well, but it is also important to select seed which is as near perfect as possible for producing strong, vigorous plants. In extensive experiments at Guelph we have found that with the cereal crops the large, plump seed will produce about one-fifth larger yields than either small plump or shrunken seeds. From the very extensive experiments which we have conducted we feel confident that in the case of wheat, oats, barley and peas a large, plump seed will on the

average produce a more vigorous and productive plant than a small, plump seed of the same variety. In order to show the influence of one year's seed selection on crop production I present the results of the following experiments conducted at the Ontario Agricultural College. It will be understood that the results represent simply the one year's influence from seed selection, but in order to ascertain the influence from one year's work of this selection, the experiments were repeated from season to season in order to secure a good average of conditions of soil, temperature and rainfall. For the large sample, none but well-developed seeds were selected; for the medium sized sample, the seeds selected were of a uniform character, plump and of medium size; and for the small sample, none but sound, plump, and apparently good seed of small size were used. The selections were made with great care by the use of sieves and then by hand-picking the seeds, so that all the seeds of each selection would be very uniform and true to its particular selection.

In the selection of large, plump grain, a sufficient quantity of each class to sow a plot twenty-five links square was carefully weighed out, after which the grains were counted. A corresponding number was then taken of the medium-sized seeds of oats and of small, plump seeds of oats, barley, spring wheat, winter wheat, and field peas. The different selections were sown upon plots of similar size.

The following table gives the average results obtained from the various selections of grain crops sown for six, seven and eight years in succession:

Seed Grain Selections.

Class of Grain.	Number of years that tests have been repeated.	Selections.	Weight of grain per measured bushel.	Tons of straw.	Bushels of grain (by weight).
Oats	7	Large seed	33.2	1.9	62.0
		Medium sized seed	32.2	1.8	54.1
		Small seed	31.8	1.8	46.6
Barley	6	Large plump seed	49.5	1.5	53.8
		Small plump seed	48.8	1.5	50.4
Field Peas	6	Large seed	56.3	1.3	28.1
		Small seed	56.3	1.1	23.0
Spring Wheat	8	Large plump seed	59.1	1.4	21.7
		Small plump seed	58.3	1.3	18.0
Winter Wheat	6	Large plump seed	59.4	2.6	46.9
		Small plump seed	59.2	2.2	40.4

The average results here presented in tabulated form show that in every instance the largest seed produced the greatest yield of grain. In no case did the smaller seed produce a greater yield of straw or a greater weight of grain per measured bushel than the seed of a larger size, but in three instances the results were similar.

On making an examination of the detailed results, it was found that in forty separate tests made with seed grain of different sizes, the greatest yield of grain per acre was produced from the larger seeds in thirty-seven of the tests, from the smaller seeds in two of the tests, and the yields were equal in one test.

In order to show that seed can be rapidly increased let me state that in three years I obtained over one hundred bushels of oats from a single plant. From a seed which was planted in the spring of 1903 I obtained one plant which was threshed, and the seed was sown in our plots in 1904, and the seed which was produced in that year was sown with a grain drill in 1905, and produced over one hundred bushels of oats by weight. One of our experimenters received in the third year over 900 bushels of barley from one pound of the O. A. C. No. 21 variety, which we sent to him the first year that this variety was distributed. I would much prefer using a small quantity of perfectly pure, typical seed of high quality of a particularly good variety to start with, than a larger quantity of the same variety but of which the seed might not be as pure or of as high quality. Let us, therefore, pay particular attention to quality when starting new varieties, and afterwards giving special attention in keeping the variety up to the standard. This is work which is being conducted in an admirable way by the Canadian Seed Growers' Association. Every farmer should sow nothing but seed of the very best quality, and of high vitality, of the most suitable varieties for his own particular soil and requirements.

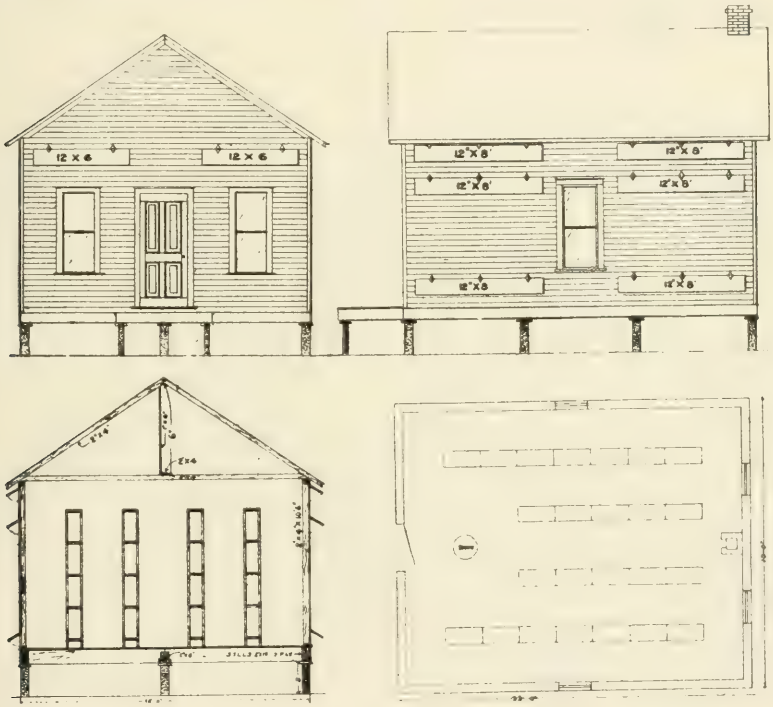
CURING, TESTING AND DISSEMINATION OF CORN.

Prof. R. A. Moore, Wisconsin Agricutural College, Madison, Wis.

I feel that I am well acquainted with all of you at the present time. I wish to thank you for the appreciation you have shown me. I do not wish to be flowery in my lecture, as that part always vanishes, but I would rather take up practical things and hammer them home so that you will not forget them. With all the great breeding work on corn, if we did not pay proper attention to the curing of the seed the whole benefit derived from the breeding is lost. Testing the seed is all right and I highly recommend it, but I put 90 per cent. on the curing, and if you do the curing right you will not need so much to do the testing. Testing shows whether or not the corn will grow, and generally it lets us get the best out of poor corn. What we really want is to get the best out of good corn; therefore the curing should precede the testing. We want a corn that will show 90 to 95 per cent. vitality. The only way for us to get this is to take the corn at the proper time of the year and drive out the moisture through the kiln-drying process of curing, which is very simple.

When taken from the stalk, corn usually contains from 20 to 30 per cent. of moisture, which, unless reduced to 10 or 12 per cent., is likely to injure the quality of the seed. One of the chief factors which enter into the securing of higher yields of corn is the curing of the seed ears. It is just as easy to cure corn in a proper manner as it is to store it away on the barn floor or in an exposed crib where it will mould or be destroyed by rats or mice. The secret in the kiln-drying of corn is the free circulation of air. If you do not have this the corn will spoil. What you want is an ordinary little building of simple construction. Saw holes in it if necessary for the circulation of air. Six bushels of seed corn will plant thirty-six acres in accordance with the check row system, placing the hills three and one-half feet apart and putting four kernels in each hill. You can dry this much in the house. Put a corn drier in the parlor; it will make a good decoration. Put up

the ears so they will not touch one another. If cured in that way you will always find a germination and vitality test ranging from 95 to 100. You cannot afford to plant poor seed corn—the risk is too great. For large and small quantities of corn, take boards 3 x 6 feet and drive in them finishing nails with a slant upward, and then stick your ears of corn up on the nails. Place the nails far enough apart so that the ears will not touch one another. When you have filled this panel, place another panel in front of it, about a foot and a half from the other and repeat this process with the nails and corn. In the side of the building have windows that can be raised and lowered at will so that they can be closed on rainy days. Thousands of bushels of corn are being dried in this way in the State of Wisconsin to-day. The panel system with the nails therein is one of the most convenient ways of drying your corn, and it is amazing the amount of corn that can be dried in a small building in this manner.



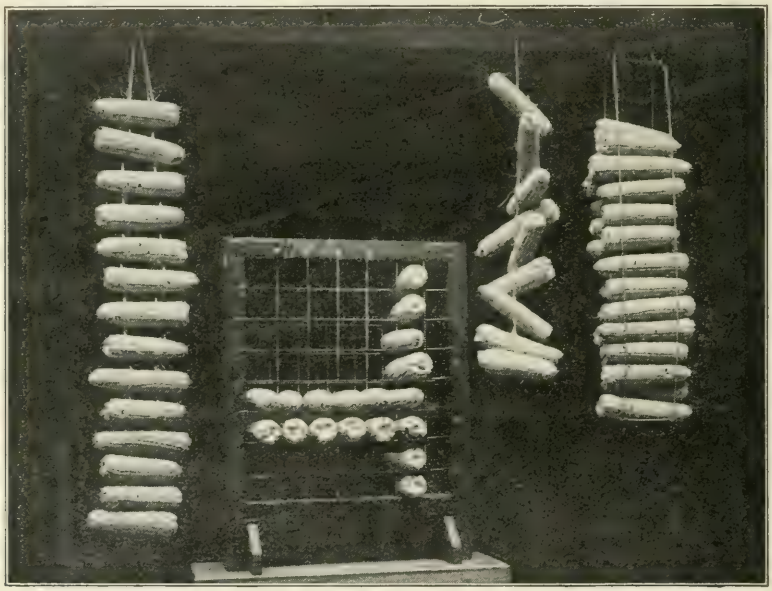
Plans for a corn-curing house where a large amount of seed corn is handled. The dimensions may be varied according to circumstances, but the ventilating doors and arrangement of racks are essential for effective curing.

Corn should never be placed against the south side of a building where there is likely to be strong sunlight, as the rays of the sun will soon injure the vitality of the seed on the side of the ear turned toward the sun. If corn is cured by hanging under a porch or under the roof of a corn crib, it should be stored away in some dry room where it will not take in moisture from the outside atmosphere before hard freezing weather sets in. Germination tests made at the Wisconsin Experiment Station showed that where corn was kept in a dry room or attic or was fire dried it gave a germination test of 98 to 100 per cent., but where left shocked in the field, in the corn crib or on the standing stalk throughout the winter the test was 0.

Things to be Remembered about Curing Corn.—1. Corn should not be dried in the direct rays of the sun. 2. Corn partially kiln-dried should not be exposed to zero weather. 3. Corn should have free circulation of air the first few days while kiln-drying. 4. After kiln-drying, corn should be placed in a dry room free from rats and mice.

Seed Corn Selection.—Select only well formed ears. By selecting the earliest maturing ears and picking them from the stalk as soon as the husks begin to turn yellow, which is a common practice, earliness is secured at the expense of vitality. A slight frost will not injure corn if it is well matured, and it is better to run the risk of a frost than to pick the ears too early. The latter part of the growing season seems to improve the vitality of the corn greatly.

Care should be taken in the picking of seed to secure ears which are attached to the stalk about three feet above the ground. Those ears which grow either very high or very low upon the stalk should be rejected, as they are undesirable, having characteristics which we do not desire. For the same reason we should avoid selecting ears with very short or long shanks or from deformed stalks.



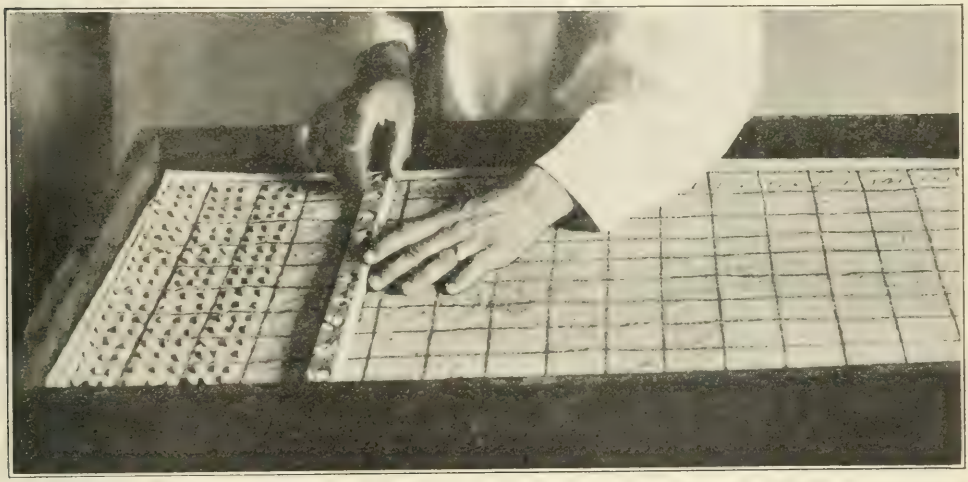
Four devices for curing seed corn. At the left the double cord is shown. The rack in the centre consists of a square frame of 2 x 4 inch strips on each side of which wires have been stapled two inches apart each way. The ears of corn are laid upon these two sets of wires. Next is shown the single cord method of tying, and at the right hangs a rack made of heavy wire, in which the ears are laid.

Go into the field after the husks on the ears have turned yellow and select the well-formed ears. Put them in sacks or baskets and bring them to the side of the field and husk. It is well to follow definite rows in securing good seed, otherwise a large number of good ears are missed. If the corn plants have been studied at a time when the corn is in the milk, and the desirable stalks marked, and the ears selected from these marked stalks after ripening, a higher grade of seed corn can be secured than by general selection. After the corn is husked, many

ears will be found imperfect and should be discarded. Only those ears should be retained for curing for seed that are of good form. Seed corn should be put into the proper place for curing the same day it is taken from the field.

Importance of Testing Seed Corn.—An increased yield of corn can be secured by testing each ear before planting and rejecting those ears that do not germinate or show lack of vigor or vitality. It is not such a tedious and difficult task to test each ear of seed corn as farmers are sometimes led to believe. Fifteen average ears of corn will plant one acre, using four kernels to the hill, placing the corn three and one-half feet apart between the rows When the importance of planting ear tested corn is fully realized few farmers will plant corn without first submitting it to the test.

Selecting Ears for Testing.—Only the most nearly perfect seed ears, having kernels of a uniform width, should be saved for seed. These should be selected from the store-room and laid out on the floor or on tables to be convenient for making the test. Care should be taken to place the ears in a building where they will not be disturbed during the period of the test, for if disarranged before



Placing kernels in the seed corn tester. Note that kernels are placed with germ side up.

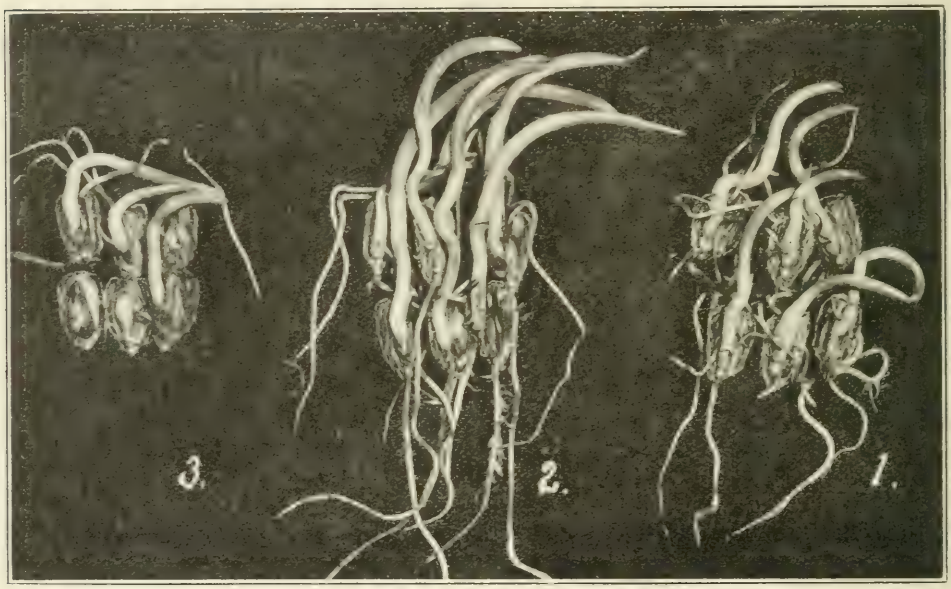
comparison can be made, the result of the test cannot be determined. The ears should be arranged in sections of ten to correspond with the sections in the seed tester which are usually in tens. A nail should be driven between each section and the various sections, and each individual ear of each section should be numbered. At least four kernels (sometimes six) are taken singly from different parts of each, and placed directly in front of the ear from which taken until kernels have been removed from all ears.

The Seed Corn Tester.—Many devices have been recommended for the testing of seed corn, nearly all of which have more or less merit. However, after using many different kinds of testers we find that the common square box tester, is the best.

A suitable box for making germination tests can be made from any common boards or siding. This is a box 20 x 40 inches and usually six inches deep. Sawdust is excellent material to use as a germination bed, but it should first be boiled in water in order to kill bacteria and moulds. The sawdust should be placed in the box about three inches deep and should be moist but not soggy.

A piece of good muslin upon which two inch squares have been drawn with an indelible pencil and numbered to correspond with the sections and individual ears to be tested, is pulled tightly over the sawdust and tacked securely to the sides of the box. The kernels of corn taken from ear No. 1 are put into square No. 1 and from ear No. 2 in square No. 2 until all are used. A plain moistened cloth is placed over the kernels and a muslin sack made for the purpose and partially filled with sawdust about two inches thick is placed on top of the cloth and pressed down firmly over the corn.

The tester should then be placed where it will be held at ordinary room temperature or a little warmer. During the day the sawdust reaches a temperature which it holds during the night. Even though the outside temperature drops several degrees that of the germination bed will be fairly constant. Usually it requires five or six days to make good tests. If at the end of three days the pad of sawdust is somewhat dry it should be moistened again.



The appearance of the kernels after testing indicates the vitality of the seed.

Checking the Results of Tests.—After five or six days have elapsed the sawdust pack should be taken off and the cloth rolled back, being careful not to move the kernels out of their respective squares. The kernels should first be inspected to note if any have absolutely failed, second if each kernel has put forth both root and growing point, and third, the vigor or vitality shown in the germination.

All ears having kernels which in the seed tester show defective germination, should be moved forward on the table three inches. After the test has been thoroughly checked up, all the ears that were moved forward are rejected and the others used as seed. Before shelling the seed remove the butt and tip kernels as these are of different shape and will not plant uniformly with the other kernels, and also do not give a uniform germination. If the butt and tip kernels are used at all they should be planted by themselves.

Dissemination of Pure-bred Seed.—Even though we breed select corn we are up against the great problem of dissemination. Through co-operation with large numbers we will be able to do away with the difficulty, but through individual efforts we will never succeed.

The great problem of dissemination of pure-bred seed corn is solved in Wisconsin through the Wisconsin Experiment Association. This association has a membership at the present time of over 2,000 members, practically all engaged in the growing and dissemination of pure-bred seed grains. Only individuals who have taken courses in the State College of Agriculture are eligible to membership, as it is the desire to only have men in the association who thoroughly understand the judging of seeds, and who are perfectly familiar with all phases of seed work. The pedigree seeds are first bred on the station farm, and then grown in increase plots until several hundred bushels are obtained. This seed is then given to members of the Experiment Association for further test and dissemination. Seed growing centers are established in each township where the member of the association also becomes a demonstrator of farm practices as well as a grower of pedigree grains. The pedigree corn, oats, barley, etc., are grown and their superiority shown over other grains. As soon as this is clearly shown there is a scramble for the grains and a desire on the part of the farmer to put into practice what he has seen done before his very eyes.

The county and state farms are also used as seed demonstration farms, and farmers living in the locality can secure the pedigree seeds from that source. Through the young people's contest work which has been in operation for six years, pure-bred varieties of corn have been widely disseminated to every part of the State. Last year 48 contests were held in 45 counties of Wisconsin. The pure-bred varieties of corn were furnished by the college, and 21,000 boys and girls took part in the work.

ALFALFA.

Prof. R. A. Moore, Wisconsin Agricultural College, Madison, Wis.

For thirty years the Wisconsin farmers grew wheat without rotation until the fertility of the land became exhausted. Nearly every farm in the state had a mortgage upon it before the true condition of affairs were fully realized. The farmers were then in desperate condition, and were willing to listen to what they considered previously theoretical farming. The line of effort proposed to them was that of dairying and proper rotation of crops in which clover figured prominently every three or four years. It is surprising the rapid strides that were made in the establishment of cheese factories and creameries. At the present time Wisconsin has 2,985 cheese factories and creameries, and the dairy output of the state is over ninety million dollars annually. One-half of all the cheese factories in the United States are located in Wisconsin and one-fifth of all the creameries.

This great feat was accomplished after thirty or forty years of ruinous wheat raising. While so great an amount of money is taken in annually by the Wisconsin farmer for dairy products, we find many hundred thousand dollars is sent away from our state for high protein feed. Our dairymen fully realize if

they are going to excel in their chosen vocation it is necessary to feed their animals a balanced ration in which we have a proper proportion of protein. In order to do this it has become necessary for them to send to the south for their high protein feed. While this practice has been commendable in the way of aiding the soil, at the same time it does not seem to me the average farmer is justified in spending so much of his hard earned money for high protein feed that can be successfully grown at home in the shape of alfalfa. Therefore, I wish to highly commend this plant to you, and hope that the few words I may say concerning this forage plant will be sufficiently interesting so that you will try at least a small acreage the coming year.

Alfalfa can truly be called the queen of forage plants. No other forage combines so many essentials of merit as alfalfa. No other plant has carried with it more gratification to the dairy farmer, nor fills such a long felt want. No forage plant is more readily relished by farm animals or exercises a more beneficial effect upon the soil.

Young exhibitors at a School Corn Show conducted by the Ontario Corn Growers' Association.

Twenty years ago alfalfa was practically a stranger in Wisconsin, but its introduction and dissemination has gone on at such a rapid pace that it seems safe to estimate that there is no less than 35,000 acres now grown in the state. The importance and popularity of the plant are such that the present acreage will probably double in the next three years.

An association of select alfalfa growers and experimenters, known as the Alfalfa Order of the Wisconsin Experiment Association, has been recently organized. The aim and purposes of the organization are to grow alfalfa and disseminate knowledge regarding it. The association is co-operating closely with the College of Agriculture so as to secure information from numerous experiments and tests to benefit all alfalfa growers of the state. The organization now has a membership of 500, and 35 tons of alfalfa seed was purchased by the

members this season. From the large numbers engaged in this co-operative work, much useful information can be secured that will be of great benefit to the alfalfa growers in general.

Feeding Value.—Alfalfa is noted for its high feeding value and the great fondness farm animals have for it.

Alfalfa belongs to the legume family, or *leguminosae,* to which the common red clover belongs. Like other members of the family it is able to use the free nitrogen of the air to build up plant tissue through the activities of certain bacteria which inhabit nodules upon the roots. However, it is able to use the nitrogen of the air thus, only when these bacteria are present.

The readiness with which alfalfa is able to take up this atmospheric nitrogen accounts for its high protein content. Well cured alfalfa hay has a total protein content of approximately 18 per cent. or a digestible protein content of 11 per cent. This large amount of digestible protein makes it rank closely with our grain feeds.

Root Growth.—Alfalfa through its large root growth exerts a beneficial effect upon the soil on which it grows, and through its power to feed on the soil elements and secure moisture at great depth below the surface is able to stand severe drouths and maintain itself upon the soil for many years without the necessity of reseeding.

Through the nature of the plant to send into the soil such a vast number of roots, the soil even though previously compact becomes porous and friable, so in later years when plowed and fitted for other crops the physical condition of the soil will be found very much benefited. The great mass of root growth which decays when the plant is killed adds materially to the humus and fertility of the soil, and thus enables the farmer to have a field high in fertility where he can grow fine crops of corn or special seed grains. When it is desired to plow an alfalfa field the strong root growth of the alfalfa will severely interfere with the plowing, unless the plow share is kept sharp. The frequent use of a coarse file upon the plowshare will make the plowing much easier for man and team, and enable the plowman to do a better job. It is almost an impossibility to break up thickly seeded fields of alfalfa properly with a dull plow. Some farmers are supplied with special grinders for sharpening plow points and other edged tools, and with these conveniences plowshares can be sharpened mornings or evenings so as not to retard the work.

Alfalfa in the Rotations.—Except where alfalfa has become thoroughly established upon the farm, no attempt has been made to encourage a regular rotation with other crops. On account of the special care given to the selection and proper fitting of the field for alfalfa it has seemed advisable to leave the alfalfa on the same field as long as it produced well. As soon as conditions are unfavorable and the field becomes patchy and crowded with June grass and white clover it is best to cut the alfalfa late in the season and then plow. The field the following season should be put into corn or some other cultivated crop and intensive cultivation practised to subdue weeds. The year following the intensive cultivation, the field can be sown to alfalfa to advantage.

Alfalfa is capable of yielding three times as much protein per acre as clover, nine times as much protein as timothy, and twelve times as much protein as brome grass. At $20 a ton for hay, good alfalfa will yield forage valued at $100 an acre. Land that will grow alfalfa is readily worth $200 an acre. As alfalfa is a perennial plant, if established under the proper environments it will continue to grow and give three or four cuttings a year for many years.

Selection of the Field.—Caution should be exercised as to the location of the field. Alfalfa can be grown on a wide variation of soils, yet on its first trial on a farm, it is best to sow on high, well drained land. A rich clay loam on top of gravel or limestone is the ideal location, but it will grow on all types of soil, varying from a heavy clay to a medium sandy loam if other conditions are favorable. A gentle slope should be selected. On level land, water will gather on the surface from rains or melting snow, and if freezing weather follows, ice will form and smother the plants. The fields will then become patchy and should be plowed and reseeded. For the same reason a creek or river bottom that is subject to overflow should not be selected, as the alfalfa plants if submerged for a few hours, will die from suffocation. Land that has the water line only two or three feet below the surface should be avoided, as the plant needs well drained soils.

Correcting Acid Soils for Alfalfa.—The natural home for alfalfa is on limestone soils or soils that have a goodly supply of carbonate of lime in them. No matter how favorable other conditions may be, if the soil is sour and gives a strong acid reaction, it will be necessary to neutralize the acidity to some extent before it will be possible to get the best results.

Acid land can occasionally be determined by plants such as sheep sorrel and mares-tail that thrive thereon. It can always be determined by testing with blue litmus paper which can be obtained from the druggist. Take some moist earth from a few inches beneath the surface of the ground and press it firmly over a strip of litmus paper. Do not handle the litmus paper when the hands are moist as the perspiration from them may cause the paper to show an acid reaction when no acid is present in the soil. After the paper has remained in the soil for ten or fifteen minutes, if it has changed in color from a blue to a pink or red, the soil is acid, and this acidity should be corrected to a certain degree before alfalfa can be grown to advantage.

Acidity can be corrected through the application of pulverized lime rock (limestone) or dry marl, or by the use of slaked lime. The best results seem to be obtained by the use of limestone or marl. No evil results follow their use as is occasionally the case with caustic lime. Pulverized raw limestone or dry marl should be scattered over the field at the rate of one to four tons per acre. Heavy applications of barnyard manure seem to benefit most soils sufficiently to get a catch of alfalfa. After alfalfa has become well established on land high in fertility it seems to thrive even on acid soils.

Preparation of the Seed Bed.—No plant responds more readily to good treatment than alfalfa. If properly seeded it will grow and give good crops through a long series of years without reseeding and pays well for careful treatment. The beginner should sow only a small acreage until he has studied the conditions of the farm in relation to this crop. One or two acres is sufficient to start with. Land that has been in young clover sod the previous year, and then run to potatoes, corn, peas or some root crop where clean culture was practised, is most suitable. This should be fall plowed 7 to 8 inches deep so as to have a deep, mellow seed bed.

Sowing Without a Nurse Crop.—In the early spring, run the disc over the land, and then follow with a fine tooth harrow at weekly intervals until about July 1, so the weeds will sprout and be killed. This treatment will conserve moisture and heat the soil. The alfalfa seed is then sown without any nurse

crop, using 20 pounds of seed per acre. If conditions are favorable and seed is sown July 1, one cutting of alfalfa hay may be secured the same season. Alfalfa can be cut in Wisconsin with safety any time previous to September 5, provided it has reached the cutting state. Sufficient growth will be secured before freezing weather to protect the plant through winter.

The practice of sowing alfalfa with a nurse crop is being displaced by the method of sowing the seed alone, and with much better results, provided the land is not weedy. The tiny alfalfa plants should have a chance to take full possession of the ground, which they cannot do to advantage if crowded by a nurse crop. While experiments show that good catches of alfalfa are occasionally secured by the use of a nurse crop, yet much better catches and a more lasting seeding can be secured by sowing the alfalfa seed alone. The seed can be sown with a hand seeder, or when broadcasted with a seeder attachment, a slant tooth harrow should be run over the land once after seeding, to cover lightly. It should be sown less than an inch deep on clay soils, or the tiny plantlets will not be able to push their way to the surface. Land plowed in spring for alfalfa should be dragged as soon as plowed to prevent drying out, and planker or roller should be run over the land before and after seeding. Always finish by using a fine tooth harrow so as to leave the surface loose enough to prevent rapid evaporation. The alfalfa crop is benefited by a light coating of well rotted manure, or manure that is free from coarse litter. It should be put on during a dry spell or after the ground is frozen in the fall so as not to injure the plants by driving over them.

Sowing with a Nurse Crop.—If you wish to grow a grain crop the season the alfalfa is seeded, much care should be taken in preparation of the seed bed. If the land has previously grown alfalfa, it will be much easier to get a good stand than if it is the first seeding. Experiments show that on rich soil, barley is one of the best nurse crops, although oats or spring wheat may be used. The nurse crop should be sown thin, using only about half as much seed as where the cereal crop is sown alone. When alfalfa is sown with a nurse crop, the time of seeding should be governed by the best time for the cereal. If the season is extremely dry, it is best to cut the nurse crop early for hay and thereby give the alfalfa a better opportunity to grow. Otherwise the cereal crop can be left to ripen, and can be harvested in the usual manner. Many good stands of alfalfa have been secured in this way.

Soil Inoculation.—Alfalfa requires certain bacteria to act in conjunction with the plant for the successful growing of good crops. Where the soil contains these organisms in limited numbers, the plants not acted upon by the bacteria soon wither and die. In some sections of the State the ground is sufficiently supplied with the alfalfa bacteria, but there are localities where they are present in so limited a number that it seems impossible to get a good catch of alfalfa that will survive the first winter.

Sweet clover, and ordinary roadside weed, which naturally grows five or six feet tall throughout southern Wisconsin, is one of the alfalfa bacteria distributors. When a farmer is in doubt as to whether his land contains the proper bacteria, he can successfully inoculate his fields by scattering on them soil from an old alfalfa field or soil on which sweet clover has grown.

For best results one ton of earth per acre should be scattered immediately preceding the sowing of the alfalfa seed. Alfalfa responds readily to these

methods of inoculation, and nearly all plants will be found to have the proper nodules on the roots the first season of growth. If the infected soil is mixed with the alfalfa seed and then sown, a small amount of soil will inoculate a considerable area.

An excellent plan to supply the soil with the proper bacteria is to use a mixture of one-fourth alfalfa and three-fourths clover or grass seed to seed down a portion of the farm. The clover or mixed hay will be of a better grade with alfalfa grown in connection. The alfalfa plants that survive become bacteria producers and distributors for future crops of alfalfa.

After alfalfa has been grown and fed upon the farm, and the manure made from the alfalfa scattered over the farm, all the soil on the farm soon seems to be filled with the proper germs. Where exceedingly heavy applications of barnyard manure are placed upon small areas, the alfalfa does well, and in the second year of its growth has the proper nodules even in the absence of inoculation.

Cutting Alfalfa.—Where alfalfa is sown as described, no hay crop can be expected the first season except under the most favorable conditions. In no event should the alfalfa be cut or clipped after September 5th. The year following seeding, three good crops may be expected. The first crop will be ready for cutting early in June, a trying time for curing alfalfa. Cut when the alfalfa is in advanced bud and a few plants in blossom, on a day that promises fair weather. Occasionally the alfalfa will come into bud and hesitate to blossom; sprouts will then immediately start at the base. It should be cut when those conditions prevail even though no blossoms appear.

Much of the feeding value is lost through stacking, as the hay is porous and rain penetrates the stacks two or three feet. However, little of the alfalfa is lost when stored under cover. An outside mow with roof does fairly well, or a covering of marsh hay or a tarpaulin will prevent damage to the stack. It is well to let the alfalfa sweat in the cock, otherwise it will heat and get musty in the barn or stack.

Alfalfa as a Soiling and Pasture Crop.—No forage plant will so conveniently give such good returns throughout the summer as alfalfa. The crop is ready to cut for soiling about June 1, and can be cut continuously until September 5. By beginning to cut early and arranging so that daily cuttings can be taken through the advanced cutting state it is possible to have good succulent alfalfa throughout the summer. In good growing weather a crop will mature sufficiently for soiling purposes in twenty or thirty days.

Alfalfa has not yet come into general use in Wisconsin as a pasture crop. The attempts so far made have proven disastrous to the alfalfa. There is no doubt that it will make an excellent pasture, but stock relish the plant to such an extent that they pasture it too closely. Only a limited number of animals should be turned in, so that the fields may be pastured and cut for hay also. As a hog pasture, no plant can excel alfalfa. Ten to twelve medium sized hogs can be pastured on an acre. The surplus alfalfa in the hog pasture when mature should be cut and made into hay.

Ruminants such as cattle or sheep, often bloat when allowed to pasture on luxuriant growths of moist alfalfa, but there is not much danger after the alfalfa is in blossom during dry weather. Green alfalfa serves well as a soiling crop.

The great amount of valuable forage taken from a limited acreage has led many to think that a large portion of the farm should be sown to this important crop regardless of conditions. A word of caution to farmers who have never grown alfalfa is necessary. Try only a limited acreage on the start, not more than one or two acres, for the purpose of studying the plant and the soil conditions on the farm. The longer alfalfa is grown and fed upon the farm, the more ideal the conditions for successful growth become, and we feel the day is not far distant when alfalfa will be grown quite as generally as common red clover.

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